SUGAR INTAKE IN THE UNITED STATES: AN "INESCAPABLE" TRAP

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Abstract

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This thesis examines the role of sugar in the American diet, the population’s health, and the economic and political spheres. The thesis aims to answer three overarching questions: (1) How has U.S. sugar consumption changed over time, and how has this change impacted the nation’s health? (2) Why does the U.S. food system allow for sugar’s continued prominence in the population’s diet if it negatively impacts the nation’s health–which this thesis argues it likely does? and (3) How can the nation improve and decrease its sugar consumption in the future? To answer these questions, information from both primary and secondary sources has been accumulated and analyzed to generate new insight on the topic of sugar in the American diet. The goals of this thesis are to reveal the truth about sugar and the organizations that foster its consumption, to recognize the modern health movement and the headway it has made in moderating sugar intake, and to present a realistic take on what is necessary to escape this sugar trap the country is caught within.

Table of Contents

Introduction

In some form or another, sugar is a delicious staple in every American's diet. While the majority of the population is aware that eating too much sugar on a regular basis is unhealthy, most do not know how little sugar is *actually* too much, nor do they realize how drastic the damaging effects of sugar can be. Although the general public has recently become more conscious of sugar intake due to increased publicity on the matter, that awareness has not been effective in prompting noteworthy dietary change (Trust for America's Health, 2018 & Haspel, 2016). As a nation, the U.S. (United States) still consumes exorbitant amounts of sugar, and it appears as though the population is slowly poisoning itself as a direct result of this habit (Yang et al., 2014; Lesica, 2017; Lustig, 2013; Olefsky & Glass, 2010; Gale, 2013; Vander Heiden et al., 2009; Cleave, 1940). Health professionals and industry leaders are aware of sugar's potential toxicity when it is consumed at current rates, but they have accomplished little to exact meaningful change in the country's food system (Nestle, 2012, p. 20; Trust for America's Health, 2018; Haspel, 2016). Radical change is crucial: in order to cultivate a strong, robust U.S. population, the country must put a stop to its gluttonous sugar consumption. This thesis discusses where the U.S.stands in terms of its current sugar consumption, why that current state is harmful, and how the nation can progress toward healthy sugar consumption in the future.

This thesis examines the role sugar plays in the American diet, the nation's health, and the economic and political spheres. In the first three chapters, the thesis explores how the country's sugar consumption has changed over time, and how this change seems to have negatively impacted the population's health. Health and nutrition experts are almost certain that the high amounts of sugar the U.S. population currently consumes are detrimental, and yet, they

have–up to this point–failed to alter the food system to reduce the country's sugar intake to healthy quantities–why? If excessive sugar consumption is now strongly suspected to increase one's chronic disease risk–which this thesis argues it is–why does the U.S. food system allow for, and even promote, sugar's continued prominence in the population's diet? Chapters Four and Five answer this question, revealing the lengths to which the government and food industry go to downplay and hide the potential dangers of excess sugar consumption. Then, Chapter Six discusses how to proceed: how the nation can decrease its sugar intake and improve its health. Here, the thesis acknowledges the progress the government has made thus far in its efforts to decrease sugar consumption and explains what is required of it moving forward; this chapter brings a variety of authors' viewpoints together to synthesize the best possible strategies for the future. The main objectives of the thesis are to reveal the truth about sugar and the organizations that foster its consumption, to recognize the modern health movement and the headway it has made in moderating sugar intake, and to present a realistic take on what is necessary to escape this sugar trap the country is caught within.

The word "sugar" can refer to a slew of different things. Technically, sugars are a group of carbohydrate molecules made up of carbon, hydrogen, and oxygen. There exists a multitude of different kinds of sugar, and their names all end in -ose (glucose, fructose, sucrose, dextrose, lactose, etc.). Table sugar is the version typically associated with the vague, overarching term "sugar," but its more technical name is sucrose, and it is made up of equal parts glucose and fructose (monosaccharides) bonded together to form a disaccharide. Fructose is the component of sucrose that makes it particularly sweet, and it is found in nature in foods like fruit and honey. Because a vast array of non-sweet, very healthful foods contain glucose, some researchers have

hypothesized that–consumed in the high quantities of today–fructose is the aspect of table sugar that is problematic for one's health (Lesica, 2017). However, fructose is essentially never consumed without the glucose bonded to it, so researchers *should* distrust sucrose–the combination of the two. Another almost identical sugar–one that is vilified much more than table sugar–was introduced in the late 1970s: high fructose corn syrup (Taubes, 2016, p. 25). There are multiple formulations of high fructose corn syrup, but the most common is HFCS-55, identified as such for its composition of 55% fructose and 45% glucose (Taubes, 2016, p. 25). The use of HFCS spread as the obesity epidemic began, so it was demonized as the culprit, but modern research shows that the body's responses to sucrose and HFCS-55 are practically identical (Bray et al., 2004 & Tappy & Lê, 2010). Both HFCS and sucrose are caloric or nutritive sweeteners, as opposed to artificial sweeteners such as sucralose, aspartame, and saccharine, which are essentially calorie-free. As the potential risks associated with artificial sweeteners are complicated and controversial enough to warrant their own discussion, this thesis will focus on caloric sweeteners. Because sucrose and HFCS are the most commonly used caloric sweeteners, when the term "sugar" is used, these are the substances it refers to unless otherwise specified. However, as HFCS did not appear until the 1970s, the word "sugar" in a context prior to this time will refer only to sucrose.

When consumed in its natural form and in moderate quantities, sugar is not dangerous; humans are designed to consume sugar this way. When people eat sugar inherent within whole foods, they are simultaneously consuming fiber, vitamins, minerals, and phytochemicals that these natural foods containing sugar also provide (Wilett & Stampfer, 2013, p. 79). However, when food producers concentrate that natural sugar and infuse it into nutrient-poor, processed

foods (like candy, dairy desserts, grain-based desserts, etc.), not only do the resulting products contain much more sugar than whole, natural foods, but also they lack those other key components that help the body digest the sugar properly (Lesica, 2017, p. 19-20). Chapter Two thoroughly explains how human bodies process sugar, but the reason for briefly summarizing it here is to clarify that this thesis does not argue that all sugar is deleterious but rather, that *the manner in which the U.S. population now consumes sugar*–in excessive quantities and in foods devoid of essential nutrients–is what makes it problematic.

One last clarification that must be made is in regard to the statistics presented throughout this thesis. Through the 1970s, the numbers typically cited for annual per capita sugar consumption actually refer to sugar deliveries, which are calculated taking domestic sugar production, plus sugar imports, minus sugar exports, and dividing that by total population (Putnam & Haley, 2003). These delivery numbers are obviously higher than true consumption was, but because they are the only records available, they must suffice. In the 1980s, however, the FDA began reporting consumption estimates using survey data, so from this period until the present, authors and researchers have relied upon these consumption estimates instead of delivery numbers (Glinsmann et al., 1986). Therefore, when the thesis refers to sugar consumption before the 1980s, it presents delivery numbers, and after, it presents consumption estimates. These FDA surveys ask people to recall what they ate and drank during a certain period of time, so the data they gather is likely inaccurate: often people's *reported* sugar consumption is much lower than actual consumption (USDA, 2019). Although consumption estimates and deliveries are both inaccurate representations of true consumption rates, they are utilized here to identify trends and make inferences regarding actual consumption.

Chapter One: U.S. Sugar Consumption

The human diet has evolved considerably over time with changes in lifestyle and technology. Humans began their existence as hunter gatherers, then gradually transitioned to domesticating plant and animal food sources, and relatively recently jumped to industrialized, commercialized food production (Friedmann & McMichael, 1989). The overall makeup of the world's diet did not change drastically until the last transitional phase, when every Western nation began consuming mostly processed foods rather than natural, whole foods (Winson, 2014, p. 25). Because almost all processed foods available today contain added sugar, this heightened processed food consumption has caused a dramatic increase in the world's sugar consumption as well (Taubes, 2016, p. 43). Sugar is a naturally occurring component of non-processed, whole foods, and the human body is designed to process it as consumed through these foods. The body is not, however, made to process the record high amounts of sugar people consume today through processed foods, nor is it evolutionarily accustomed to this dietary transition, as it occurred very recently relative to the human species' overall history (Winson, 2014, p. 25). Although experts are currently unsure of *exactly* how much sugar people should consume on a daily basis, they are certain that today's rates are too high (HHS & USDA, 2015; WHO, 2018; AHA, 2018).

Historical Consumption: How Has Sugar Consumption Evolved Over Time?

Early History

Sugar was first cultivated in India over two thousand years ago, where it was consumed as both sugarcane juice and in its crystallized state (Deerr, 1950, p. 68). Around the first century

CE, Buddhist missionaries in India discovered the crop and brought sugar back to Japan and China (Deerr, 1950, p. 68). A few centuries later, Muslim explorers took sugar from China back to Arabia, and the growth of the Muslim Empire–which began in the seventh century–spread sugarcane throughout the Mediterranean (Deerr, 1950, p. 68). Sugar later began its journey into northern Europe with the Crusades in the eleventh century, and at this time it was utilized as either a medicine, a decoration, a flavor-enhancing spice, or a preservative (Mintz, 1985, p. 28). For the next several centuries, sugar was considered an "additive" rather than a true source of energy–a "spice" rather than a food–and it was consumed for its believed medicinal properties as much as it was for any other reason (Mintz, 1985, p. 99). Regardless of its particular purpose, sugar was rare and expensive and, therefore, was consumed very modestly until the late eighteenth century (Mintz, 1985, p. 75).

Sugar production required vast stretches of land in a tropical climate, an extra long rainy season or an extensive irrigation system, and a large labor force to plant, harvest, and refine it (Deerr, 1950, p. 115). As a result, sugar was a costly luxury reserved for those wealthy enough to afford it throughout the majority of its history (Mintz, 1985, p. 96). It was not until the late 1700s that sugar began its transition to become the relatively inexpensive, ubiquitous commodity it is today (Mintz, 1985, p. 75). The primary factor in decreasing sugar's cost and increasing its availability was technology: the industrial revolution, incited by the invention of the steam engine in 1765, transformed sugar production, speeding up the process exponentially and making it much less labor intensive, therefore much cheaper (Mintz, 1985, p. 129). Another factor in sugar's transformation was the development of the beet-sugar industry in the early 1800s, which occurred when the French perfected the process of refining sugar from beets (Deerr, 1950, p.

475-9). Because beets grow successfully outside the tropics in temperate climates, the introduction of the beet-sugar industry dramatically increased the viable land available for sugar production, thereby increasing the availability of the commodity and decreasing its price even further (Deerr, 1950, p. 475-9). Within just a couple of centuries sugar went from a "luxury of kings to the kingly luxury of commoners": its original status as a symbol of power and wealth carried over across its transition and made it all the more desirable to the middle and working classes to whom it became newly available (Mintz, 1985, p. 96).

The Industrialization of the Food Industry

Although sugar had become a popular household commodity by the early 1800s, it was not consumed in quantities comparable to those of today until about a century later (Abbott, 2011, p. 372). In the early 1800s Americans were estimated to consume about 8.4 pounds of sugar per person per year, and by 1905 that number had skyrocketed to 70.6 pounds (Abbott, 2011, p. 372). This drastic spike in sugar consumption was the result of the industrialization of the food industry, which brought with it the advent of mass-produced processed foods (Mintz, 1985, p. 129-47). Until the mid-1800s Americans consumed sugar in their tea, coffee, and chocolate beverages, in honey, jam, and marmalade, and through home cooking and baking; absent were all the mass-produced products through which Americans consume most of their sugar today–candy, chocolate bars, ice cream, packaged baked goods, sodas, and juices (Mintz, 1985, p. 129-47). Candy, chocolate bars, ice cream, and soft drinks were all introduced throughout the latter half of the 1800s, and these products contributed substantially to the rise in sugar consumption that occurred at this time (Hess & Hess, 2000, 57-60). Moreover, bakers began adding sugar to flour in the 1900s as fuel for yeast to make bread rise faster and to make it

more palatable, making bread another contributing factor in the nation's steadily increasing sugar consumption (Hess & Hess, 2000, 57-60). Later, in the decades following World War II, the rise of sugar-laden fruit juices and breakfast cereals introduced additional channels through which people could and would fall victim to excessive sugar consumption (Hamilton, 2009 & Bruce & Crawford, 1995).

Mass marketing, another product of the industrialization of the food industry in the US, spurred increasing sugar consumption as well (Winson, 2014, p. 114). Within a matter of decades, only a handful of huge, transnational manufacturers were left producing this new array of mass-produced, sugary food (Winson, 2014, p. 114). Oligopolistic control of the food and beverage markets–made possible by innovations such as the factory system, the network of railroads, and the telegraph–took place quickly at the close of the nineteenth century with the concentration and centralization of capital in the hands of the most powerful firms in the industry (Winson, 2014, p. 114). As is common when there exist few sellers in a market, firms began mass marketing campaigns in order to differentiate their product–their brand–and gain an advantage over their competitors (Baran & Sweezy, 1966, p. 116). Mass advertising blossomed in the food industry through newspapers, magazines, and later, radio ads, not only to convince consumers to purchase one brand over another, but also to normalize the consumption of these new foods (Winson, 2016, p. 24). Until the industrialization of the food industry, people were accustomed to eating primarily whole or minimally processed foods. Mass advertising was employed to transform highly processed, industrial foods into socially acceptable sources of nourishment (Winson, 2016, p. 24). Processed food manufactures marketed their products as convenient and time-saving, as more "pure" and "clean" than natural, unfiltered foods, and as

symbols of social status (Winson, 2016, p. 25). As a result, what might have been seen as a disturbing departure from traditional food became a socially desirable alternative to it (Winson, 2016, p. 25). These giant American food producers succeeded in using mass marketing to both normalize highly processed, sugar-infused foods and differentiate themselves as brands and indirectly propelled already climbing sugar consumption in the process.

From WWII to The Twenty-First Century

During World War II, U.S. sugar consumption dipped temporarily due to sugar rations, but once the war was over, consumption spiked right back to where it was previously and continued climbing through the second half of the twentieth century (White, 1945 & Blodget, 2012). A variety of factors contributed to this trend of steadily advancing sugar consumption in post-war years. First, the abolition of sugar rations led to record high demand for ice cream, candy, and soft drinks (Quinzio, 2009, p. 200). Second, transnational food manufacturers increased in number and size as the country and its economy grew, and with this economic expansion, came a consistently increasing variety of processed, sugary food products available on the market (Popkin, 2006, p. 289-98). Meanwhile, supermarket and convenience store chains began to spread throughout the country, which provided the U.S. population with easy access to this new variety of sugar-infused food (Jaffe & Gertler, 2006). Lastly, a dramatic shift in dining norms occurred at this time with the introduction of fast-food chains and widespread full service restaurants; these new establishments transformed dining from a primarily domestic activity to one that occurred outside the domestic sphere just as often as it did within it (Jaffe & Gertler, 2006). The last few factors explained here transferred an aspect of control over dietary choices from the individual into the hands of a business entity, whose primary focus is profit, not health

or nourishment. When these businesses added sugar to their food, it became more palatable and sold better, so that is exactly what they often did (Bruce & Crawford, 1995, p. 111). And as a result, the average American began unknowingly consuming more and more sugar than ever before (Bruce & Crawford, 1995, p. 111).

Sugar had reached unprecedented levels of ubiquity: in 1999 *150 pounds* of sugar was sold for each man, woman, and child in the United States (USDA ERS, 2019). The fact that this figure represents sales and not consumption rates is significant; the average consumption rate was surely lower than this once waste was accounted for. However, consumption was indubitably much higher than it was just one century earlier at 70.6 pounds per person per year and *excessively* higher than it was two centuries earlier at a mere 8.4 pounds per person per year. In sum, by the turn of the century, sugar consumption had reached disturbingly high rates relative to those in history.

Current Consumption: How Much Sugar Does the U.S. Population Consume?

Sugar sales have remained rather consistent since the start of the twenty-first century (Moss, 2013, p. 24). Although it is problematic to estimate how much sugar the country actually consumes from sales figures, researchers have arrived at some tentative estimates recently based off survey data. As explained in the introduction, because these statistics come from self-report data, they are most likely more conservative than they should be. That being said, the average American adult is estimated to consume approximately 22 teaspoons of sugar per day which is equivalent to about 100 pounds per year, and children are believed to consume even more than that (Moss, 2013, p. 24). Expressed in terms of overall energy intake, most American adults

consume between 15 to 25 percent of their calories from added sugar on a daily basis (Yang et al., 2014, p. 522). These statistics make sense due to the ubiquity of sugar within the U.S. food and beverage market.

The most significant sources of added sugar in the average American adult's diet are sugar-sweetened beverages, grain-based desserts, dairy desserts, fruit drinks, and candy, but Americans consume sugar through a wide variety of other foods as well (Lustig et al., 2012, p. 28). Not only does sugar make foods sweeter and tastier, it also acts as a preservative in processed foods, functions as fuel for yeast in helping bread products rise, and reduces the harshness of salt used in curing and preserving meat (Pennington & Baker, 1990). Therefore, sugar is present not only in the excess of *sweet* processed foods on the market, but also in salad dressing, barbecue sauce, ketchup, canned soups, bacon, cold cuts, meat marinades, hot dogs, crackers, nuts, chips, nut butters, spaghetti sauce, canned vegetables, and bread (Taubes, 2016, p. 43).

Moreover, many foods marketed as "health foods" or healthier alternatives to "junk food" actually contain excessive amounts of added sugar and are little more healthful than what is generally recognized as junk food (Winson, 2014, p. 176). Recently, both consumers and government health officials have become more and more concerned with healthy eating due to steadily rising rates of obesity and related health problems. In response to this concern, numerous processed food manufactures have "fortified" their products with vitamins and nutrients, making them seem healthier (Singer, 2011). Breakfast cereals, juice drinks, and baked goods are some of the most commonly fortified foods, but this trend has now seeped into almost every category of the food industry (Singer, 2011). In reality, injecting these products with concentrated forms of

nutrients extracted from their true sources makes these foods little to no more healthful than they were without the additions; these "fortified" foods simply cannot replace the full range of nutrients and phytochemicals found in whole foods (Singer, 2011). These foods trick consumers into thinking they are eating healthfully, but the excessive sugar content of these products undermines any health goals consumers may aim to achieve by eating them (Singer, 2011).

Not only is sugar present in almost every type of processed food product available–even the "healthy" or "healthier" ones–but also supermarkets display these products most prominently: non-processed and minimally processed foods typically lie on the outskirts of the store, while the highly processed products make up the center isles and the eye-catching island displays and isle ends. Supermarkets sell this shelf space to giant, corporate brands that sell unique, differentiated, processed food products because they are typically the only ones that can afford this prime real estate (Winson, 2014, p. 198).

Another dietary element enhancing modern sugar consumption is the increasing tendency to eat meals away from home. In just five years from 2000 to 2005, Americans went from spending about $1,200 to $1,600 (in terms of 2007 U.S. dollars) per person per year on food eaten out, and that number has undoubtedly soared much higher since (USDA ERS, 2019). Americans often consume more sugar eating out than in because of the economic benefits that adding extra sugar provides a business (explained in the previous section) and because of the larger portion sizes typically consumed when eating out.

The last–and most significant–contributing factor in the nation's high sugar intake is soft drink consumption (Lustig et al., 2012, p. 28). On average, the U.S. produces enough regular soda annually to provide every man, woman, and child with 1.2 twelve-ounce sodas every day;

that results in every single American consuming 200 calories per day from this source alone (Center for Science in the Public Interest, 2017). Again, this number represents production not consumption, but survey data indicates that consumption rates are quite high as well (CDC, 2019). Moreover, a much greater portion of America's sugar intake–approximately 39% of it–comes from sugar-sweetened beverage consumption than from any other source, and soft drinks are the primary contributor within this category (Bailey et al., 2018). This makes sense in that practically all the calories in soft drinks in particular come from their sugar content, and they contain little else that provides any sort of nutritional value; drinking them is essentially drinking liquid sugar (Jacobson, 1998).

In these numerous different ways, the modern U.S. food industry has made sugar practically unavoidable; the country's current food environment promotes the excessive sugar intake the nation stomachs.

Recommended Consumption: How Much Sugar *Should* the Average American Consume?

The answer to this question is that even health and nutrition experts simply do not know; there is no way to know. The thesis explains this further in upcoming sections, but it is impossible to say how much sugar is too much and exactly how much is safe because it takes years–sometimes lifetimes–for excess sugar consumption to impact one's health in a noticeable way. In addition, sugar impacts different people in vastly different ways depending on age, gender, race, genetics, the list goes on. Therefore, a study to determine exactly how much sugar is tolerable for the average person would require controlling every aspect of a significant number of human subjects' lives for years, which is unethical and unrealistic; it would never be tolerated.

Moreover, research shows that throughout the past two hundred years, Americans may have altered their genetic makeup through their extreme sugar consumption, and as a result, they may be passing a predisposition for increased sugar sensitivity down from generation to generation (Taubes, 2016, p. 278). So, while a certain amount of sugar may be tolerable for one generation, it may not be safe for the next (Taubes, 2016, p. 278).

This ambiguity makes any attempt at concrete, published recommendations for sugar consumption difficult and controversial. Over the years, each time government agencies have tried to restrict the nation's sugar consumption in any way, they have faced aggressive push back from the sugar industry, which has almost always succeeded in either modifying the proposed advice or silencing the industry's health-promoting enemies altogether (more on this in Chapters Five and Six). In place of any hard limits regarding sugar consumption, the sugar industry has often successfully pushed for vague recommendations and more euphemistic advice. For example, one recent scholarly article on healthy eating advises that "sugar intake be minimized," and another recommends simply "reducing calories from added sugar" (Willett et al., 2013, pp. 86 and Guenther, 2013, pp. 573). This industry influence is visible in the majority of sources– both independently researched and government funded–on advice for healthy eating. Chapter Six discusses the industry's political influence in much greater depth, but for now, suffice it to say that throughout recent history, recommendations for daily sugar consumption have been substantially shaped by the sugar industry. Even when government agencies, private health organizations, and the like *have* succeeded in publishing restrictive recommendations for daily sugar intake, the sugar industry has countered these sources, funding their own to support more liberal guidelines for sugar consumption (Rolnik, 2016).

Both the World Health Organization and the American Heart Association have recently succeeded in overcoming the sugar industry's political power and have published more strict dietary guidelines regarding sugar consumption, which they still support as this is written (WHO, 2018 and AHA, 2018). The American Heart Association recommends that total added sugar consumption remain below 150 calories per day for men and 100 calories per day for women (AHA, 2018). The World Health Organization is equally restrictive in its recommendations claiming that only 5% of one's total daily calorie intake should come from added sugar, which equates to just 100 calories given a 2000-calorie diet (WHO, 2018). In order to abide by these standards, the average American adult would need to decrease his or her daily sugar intake by about 70 percent to just 6 teaspoons per day (Yang et al., 2014, p. 522).

Perhaps this advice is too stringent, but perhaps it is not. Again, there is truly *no way* to know for certain, but the ubiquity of sugar in the U.S. food environment makes even mildly restrictive sugar consumption standards difficult to follow. However, if Americans did manage to do so, evidence suggests that this new diet would yield a healthier population (Yang et al., 2014; Lesica, 2017; Lustig, 2013; Olefsky & Glass, 2010; Gale, 2013; Vander Heiden et al., 2009; Cleave, 1940). Chapter Two explains exactly why this is so in discussing sugar's impact on the body and its relation to chronic disease.

Chapter Two: Sugar and Western Disease

The term "Western diseases" refers to a collection of chronic health conditions (such as cancer, heart disease, dementia, etc.) that often arise in a population following their adoption of the more modern, progressive diets and lifestyles that originated in Europe and, as a result, became known as Western (Trowell & Burkitt, 1981). This name, "Western diseases," was first used by medical researchers Burkitt and Trowell in 1981 when they studied these chronic afflictions and published a provisional list of them (Trowell & Burkitt, 1981). They so named these diseases, instead of referring to them by their more commonly used name at the time, "diseases of civilization," because they did not wish to imply that the communities where these disease were uncommon were uncivilized (Trowell & Burkitt, 1981). Burkett and Trowell's term is still used today along with others such as "diseases of civilization" and "diseases of affluence," but this thesis will refer to these conditions as Western diseases.

The human body is extremely intricate and complex, and there is no limit to the aspects of day-to-day life that have some impact on the body and influence how it functions. Moreover, each person's body is unique and responds to stimuli from the outside world in its own distinct way. As a result, it is practically impossible to identify one singular cause of Western disease from the millions of factors or combinations of factors that could provoke it. That being said, there exists a preponderance of evidence to suggest that sugar consumption does play some role in the development of Western disease; it is not the only significant factor, but it is likely one of them. As British researcher Thomas Cleave reasoned, "It would be an extraordinary coincidence if these [sugar-filled] refined carbohydrates, which are known to wreak such havoc on the teeth [i.e. cause tooth decay], did not also have profound repercussions on other parts of the alimentary

canal during their passage along it, and on other parts of the body after absorption from the canal" (Cleave, 1975, p. 24). This chapter explains these "profound repercussions" that sugar seems to have on the human body, and it illustrates how these negative health impacts are thought to come about as a direct result of excessive sugar consumption. Moreover, this chapter presents the plethora of logic-based and circumstantial evidence to support the hypothesis that sugar causes chronic disease.

Digestion: The Body's Short-Term Reactions to Sugar

The human body uses both fat and glucose from the food humans consume for energy. Sugar, as defined in the Introduction, is made up of both glucose and fructose, and high amounts of fructose consumed at once are challenging for the body to digest; this is where health problems associated with excessive sugar consumption begin (Lesica, 2017, p. 20). In order for one's body to utilize fructose for energy, it must first process it in the liver, convert it to fat, and release it back into the blood (Lustig, 2013). However, the liver can only process fructose at a set rate, and if too much is eaten too quickly, the liver converts it into fat faster than it can release it all into the blood (Lustig, 2013). When this occurs, excess fat builds up in the liver, which can cause it to function abnormally and even damage it permanently (Lustig, 2013). This lasting condition is called fatty liver disease, and it currently affects approximately 25% of adults in the U.S. (Lazo, 2013). Damage to the liver and the build-up of fat that causes that damage both elicit an immune response because these are abnormalities that one's immune system interprets as problems it should correct (Lesica, 2017, p. 153). That response comes in the form of inflammation in the area and a release of several hormones (Lesica, 2017, p. 33). One of these

hormones is insulin, which functions to regulate fat storage and usage within the body (Lesica, 2017, p. 32). A release of insulin sends the message to certain cells to take up fat and store it, so the immune system attempts to clear this fat build-up that fructose has caused in the liver using this hormone (Lesica, 2017, p. 33). If this response occurs occasionally, it is effective and harmless, but if it occurs too frequently, it can cause insulin resistance–a state in which the body is so accustomed to high levels of insulin that it becomes unresponsive to it (Olefsky & Glass, 2010). Normally, insulin secretion signals the body to use glucose in the blood stream for fuel, to store some glucose in the liver and to stop producing it there, and to store triglycerides, or fat, within fat cells so it can use that as fuel later, when blood glucose is low (Lesica, 2017, p. 17). However, once insulin resistance sets in, blood glucose and blood fat levels become chronically elevated because the insulin the body produces no longer suffices to regulate them (Olefsky & Glass, 2010).

Leptin is another hormone that regulates fat storage within the body, and the immune system utilizes it in its response to excess, un-stored fat as well (Yang & Ruan, 2015). Therefore, leptin resistance often develops in conjunction with insulin resistance (Yang & Ruan, 2015). Leptin sends messages to the brain regarding the amount of fat stored in fat cells, and in doing so, it helps to regulate weight (Yang & Ruan, 2015). If leptin resistance occurs, however, the brain fails to acknowledge the fat content within cells and perceives a lack of stored energy (Yang & Ruan, 2015). It then sends signals throughout the rest of the body that cause the individual to continue to eat, when he actually does *not* need more energy, and his endocrine system *should* (if it were functioning properly) signal him to eat less in order to adjust back to his natural body weight (Yang & Ruan, 2015). As a result of this process, leptin resistance

eventually causes obesity, which stimulates increased inflammation and additional health issues (Yang & Ruan, 2015).

Sugar has also been shown to promote obesity due to the way the body processes fructose and because of sugar's seemingly addictive quality (Lesica, 2017, p. 154). Because fructose must be converted into fat before it can be used as energy, the body does not register the calories from it as quickly as it does those from glucose and fat (Luo et al., 2015). As a result, it takes longer to feel full when eating foods with high amounts of sugar, which often stimulates overconsumption (Luo et al., 2015). Another way in which sugar promotes overconsumption is its resemblance to an addictive substance (Avena, Rada, & Hoebel, 2008). Whether or not sugar can truly be classified as "addictive," is controversial because researchers are unsure of which specific chemical reactions within the brain or body actually cause something to be addictive; "addictiveness" is difficult to measure or quantify (Taubes, 2016, p. 33 and Lesica, 2017, p. 163). However, a collection of studies using both humans and animal subjects have illustrated that behavioral reactions to sugar are similar in various ways to reactions to addictive drugs (Avena, Rada, & Hoebel, 2008). For example, sugar elicits the same reactions within the brain's reward center (formally known as the nucleus accumbens) as do nicotine, heroine, and cocaine (Avena, Rada, & Hoebel, 2008). Moreover, like addictive drugs, sugar has been shown to reduce the effects of dopamine on the brain over time so that less pleasure results from it than that considered normal (Avena, Rada, & Hoebel, 2008). As a result, the dopamine produced in response to food consumption does not generate the level of pleasure that it should, pushing people to overeat in order to achieve satisfaction (Avena, Rada, & Hoebel, 2008). Although sugar

may not be considered addictive in a technical sense, it is too similar to substances well-established as addictive to dismiss it as completely unrelated.

These short-term reactions to excess sugar are stressful and strenuous on one's body; if they occur repeatedly over an extended period of time, eventually permanent damage develops and manifests as chronic disease (Taubes, 2016, p. 34).

Chronic Disease Associated with Sugar Consumption

Metabolic Syndrome

The diseases most simply and explicitly tied to sugar consumption are known jointly as metabolic syndrome: a collection of conditions directly associated with cardiovascular disease and type 2 diabetes (Taubes, 2016, p. 200). The host of abnormalities that is metabolic syndrome–obesity, high blood pressure, high triglycerides, low HDL cholesterol, heart disease, high blood sugar, type 2 diabetes, and general inflammation–stems from insulin resistance and hyperinsulinemia (high insulin levels) which, as explained in the previous section, excess sugar consumption promotes (Taubes, 2016, p. 200). Insulin resistance causes high triglyceride levels and obesity in that insulin is a lipogenic, or fat-forming, hormone (Gale, 2013). Health and nutrition experts believe that when an individual becomes insulin resistant, insulin's blood-sugar-reducing ability is hindered but its fat-forming ability is not effected to the same degree; therefore, elevated insulin levels promote fat accumulation and, eventually, obesity (Gale, 2013). High triglycerides then cause high blood pressure because they lead to plaque buildup in arteries, which eventually leads to heart disease (Gale, 2013). There is much evidence to indicate that insulin also regulates cholesterol levels within the blood and that hyperinsulinemia directly

causes decreased HDL cholesterol (colloquially known as "good" cholesterol), but researchers are uncertain of exactly how this interaction plays out (Hirano, 2018). It is rather redundant to explain how insulin resistance leads to type 2 diabetes and high blood sugar, as the disease is *defined* as a condition in which the body fails to respond to insulin properly. However, not everyone with insulin resistance and hyperinsulinemia becomes diabetic. Some insulin resistant individuals simply secrete excess insulin and succeed in overcoming their bodies' resistance to it (Reaven, 1988). More often than not, however, abnormally high insulin levels exacerbate the initial resistance, which stimulates even further elevated insulin levels, and this vicious cycle continues until the patient eventually does become diabetic (Reaven, 1988).

Gout

Another disease linked to excess sugar intake is gout; although gout is a much more obscure condition than heart disease and diabetes, it afflicts enough of the population to warrant a discussion here (Zhu et al., 2011). Gout causes its victims inflammation, swelling, and intense pain in the joints of their extremities (Zhu et al., 2011). Uric acid is a compound that circulates in the blood stream as a waste product from the digestion of food; gout occurs when uric acid levels are too high, and as a result, the acid molecules fall out of solution and bond together to form sharp crystals (Zhu et al., 2011). These uric acid crystals then wedge in soft tissues and joints and cause the inflammation and pain the disease is known for (Zhu et al., 2011). Sugar consumption fosters elevated uric acid levels in numerous ways. First, insulin resistance and hyperinsulinemia increase uric acid levels in that they decrease the kidneys' ability to filter the acid out of blood (Reaven, 1997). Second, in the process of metabolizing sugar in the liver, protein compounds called purines are released; uric acid is just a breakdown product of these proteins, so consuming

fructose leads directly to increased uric acid levels in this way (Mayes, 1993). Lastly, processing fructose also raises uric acid levels *indirectly* by causing lactic acid formation, which–like insulin resistance–further reduces the kidneys' ability to filter uric acid out of the blood (Mayes, 1993). Given these closely related biochemical mechanisms behind gout, obesity, diabetes, and high blood pressure, it is not surprising that these conditions are often associated with one another and have all been tied to sugar intake.

Cancer

It *might* come as a surprise, however, that cancer is tied to sugar as well for the very same reasons. Researchers have known for several decades now that certain cancer cells respond to insulin in ways that healthy tissue cells do not (Temin, 1968). Breast, adrenal, and liver cancer cells in particular all proliferate in response to insulin and die when the hormone is absent (Temin, 1968). Moreover, all cancer cells require insulin to propagate when they are grown outside the human body as cell cultures (Temin, 1968). It was not until more recently, though, that researchers hypothesized a more intricate and significant link between cancer and insulin, which condemns insulin resistance–and therefore, sugar–as a direct cause of cancer (Vander Heiden et al., 2009). These experts believe that insulin resistance and hyperinsulinemia signal precancerous cells to take up excessive amounts of blood sugar for fuel, and as a result, these cells change the mechanism through which they metabolize glucose in order to do it more quickly (Vander Heiden et al., 2009). Burning glucose at such a rapid rate causes these cells to produce abnormally large amounts of what are known as "free radicals," compounds that have the ability to damage the DNA in the cell's nucleus (Vander Heiden et al., 2009). As these free radicals increase in prevalence, they become more likely to cause mutations in the cell's DNA

(Vander Heiden et al., 2009). The more mutations that these compounds cause, the more likely it is that one of them would allow the cell to overcome the normal cellular processes that prevent it from proliferating uncontrollably, thus transforming it into a cancer cell (Vander Heiden et al., 2009). Moreover, a hormone called insulin-like growth factor–which is similar in structure to insulin and is secreted in response to it–sends signals to cancer cells that prompt them to continue proliferating (Vander Heiden et al., 2009). So, elevated insulin not only causes cancer by providing the fuel and generating the mutations necessary for uncontrolled cell proliferation, it also fosters cancerous cell growth in enhancing the insulin-like growth factor in circulation (Vander Heiden et al., 2009). Although researchers are not certain that this biochemical explanation linking insulin and cancer development is precisely accurate (it may be the case that the DNA mutations occur spontaneously rather than as a result of insulin resistance), they *are* certain that insulin, insulin-like growth factor, and cancer cells interact in some meaningful way (Vander Heiden et al., 2009). Therefore, it is likely that insulin resistance does have some effect on the progression of cancer (Vander Heiden et al., 2009). Further support for this argument comes from the fact that there is a strong association between cancer, obesity, and diabetes (Coughlin et al., 2004). Those who are obese or diabetic are at a much greater risk of both contracting cancer and dying from the disease, 50%-60% more likely, to be exact (Calle et al., 2003). Moreover, in 2007 approximately 139,000 cancer deaths worldwide were directly attributed to obesity (Tseng, 2009). Even more compelling evidence suggesting a link between insulin resistance and cancer is the fact that those who exhibit only the less severe symptoms of metabolic syndrome–those who have become insulin resistant but are not yet obese or diabetic–are *also* at a greater risk of developing or dying from cancer (Polos & Stambolic, 2015, p.

e2037). Therefore, it appears likely that insulin resistance contributes to cancer risk in some way, and if that is the case, so does sugar intake. A recent report on cancer and diet, nutrition, and physical activity last updated in 2018 confidently asserts that everyone should limit consumption of foods and beverages high in sugar because these foods cause weight gain and obesity, which can cause many cancers (World Cancer Research Fund/American Institute for Cancer Research, 2018).

Dementia

Yet another Western disease linked to sugar consumption is dementia (Li et al, 2015). Excessive sugar intake increases one's risk for dementia because it leads to type 2 diabetes and hypertension, which are speculative causes of dementia (Li et al, 2015). Type 2 diabetes and hypertension increase one's risk of cerebrovascular disease and stroke, which cause vascular damage (less technically known as the death of brain tissue) as a result of blood vessel blockage in the brain; this vascular damage then manifests as dementia (Li et al, 2015). Type 2 diabetes and hypertension are associated not only with general dementia, but with Alzheimer's dementia specifically as well (Li et al, 2015).

Alzheimer's dementia is a certain type characterized by an accumulation of amyloid plaques and neurofibrillary tangles in the brain in conjunction with the vascular damage seen with other types of dementia (Schneider et al, 2007). Everyone accumulates some of these plaques and tangles within the brain as well as some degree of vascular damage throughout life, but it seems that whether or not Alzheimer's dementia manifests depends on the amount of vascular damage incurred (Schneider et al, 2007). In other words, while Alzheimer's is marked by these plaques and tangles, the amount accumulated in one's brain is insignificant to determine

whether or not he manifests the disease; what matters is the degree of vascular damage (Schneider et al, 2007). There is no critical amount of vascular damage required to cause Alzheimer's; that amount varies from person to person depending on various other factors like genetics and overall health, but the more damage, the more likely it is that Alzheimer's will develop for any given person (Schneider et al, 2007). Therefore, if sugar intake causes hypertension and type 2 diabetes, and these conditions cause vascular damage, then sugar indirectly promotes Alzheimer's dementia. Researchers now believe that sugar is involved in the Alzheimer's process in a much more direct manner as well: they speculate that insulin resistance could generate or exacerbate the disease in numerous ways, but because these are just speculations–and quite complicated ones–this thesis will not discuss them in detail (Li et al, 2015). Suffice it to say that, whether it be in a more or less direct manner, sugar consumption plays some role in dementia and Alzheimer's dementia.

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The host of biochemical mechanisms explained above–those which condemn sugar as the cause of these chronic diseases–may not be entirely accurate; they are still being studied and refined (Castro et al., 2014). However, there is certainly some relation between excess sugar intake, insulin resistance, and this collection of conditions because they almost always appear together in some combination or progression (Castro et al., 2014). The diseases detailed here–metabolic syndrome, gout, cancer, and dementia–are just the most widespread and consequential, though; there exists an abundance of other complications that come with insulin resistance and diabetes, from blood vessel complications leading to stroke and kidney disease, to blindness and

cataracts, to plaque deposits in the heart and the extremities, and much more (Castro et al., 2014). As Taubes so perfectly puts it:

> "Diabetes…is not a discrete phenomenon in which bad things suddenly start happening that didn't happen before. It's part of a continuum from health to disease that is defined in large part by the worsening of the metabolic abnormalities…that we've been discussing and that are associated with insulin resistance, if not caused by it, and so part and parcel of metabolic syndrome" (Taubes, 2016, p. 267).

And if sugar intake precipitates insulin resistance and diabetes, then it is at fault for a whole heap of health conditions typically viewed as unrelated.

Sugar: The Logical Culprit

The biochemistry connecting sugar intake to chronic disease makes sense, but it has yet to be proven fact; it is all still somewhat controversial (Castro et al., 2014). That being said, the plethora of evidence linking sugar and chronic disease is undeniable; sugar seems the logical culprit because of the human species' dietary history and sugar's role in that and because of the consistency of the association between sugar and chronic disease across space and time.

The Darwinian Explanation

As mentioned briefly in Chapter One, sugar has not been consumed in the processed, concentrated, superfluous ways of today until extremely recently relative to overall human history (Winson, 2014, p. 25). As twentieth century researcher Thomas Cleave wrote: sugar as it is consumed it in recent times "has been in existence little more than a century for the ordinary man, and from an evolutionary point of view, this counts as nothing at all" (Cleave, 1956).

Cleave–and numerous scholars before and after his time–blamed sugar as the source of chronic disease using an argument based on the "Law of Adaptation," applying Darwin's theories to the evolution of Western disease (Cleave, 1940). This law states that any species requires "an adequate period of time for adaptation to take place to any unnatural (i.e. new) feature in the environment, so that any danger in the feature should be assessed by how long it has been there" (Cleave & Campbell, 1966). Humans have had little to no time, roughly three to four generations, to adapt to modern-day sugar intake, in comparison to the thousands of years throughout which people consumed it only naturally and sparingly. Taking this Darwinian perspective, it only makes sense that the body is not accustomed to current sugar consumption and that it causes health problems as a result. This argument could apply to all relatively new aspects of the world's diet–all processed foods, with or without added sugar–and incriminate all of them as sources of disease, and perhaps they are. But regardless of whether the responsible party is the entire processed food industry or just the sugar industry in particular, sugar certainly plays some role in the problem.

The Evidence Linking Sugar and Disease

Although none of it is perfect, there exists an abundance of research that suggests a close association between sugar and these health problems discussed above. One study estimates that individuals who consume between 11% and 24% of their calories from added sugar increase their risk of cardiovascular disease mortality by 30%, and those who consume 25% or more of their calories from added sugar increase that risk by nearly 90% (Yang et al., 2014, p. 522). Another study, using rhesus monkeys rather than human subjects, explicitly proves the link between metabolic syndrome and sugar in these monkeys (Bremer et al., 2011). The monkeys

were given the choice to drink a fructose-sweetened beverage along with their usual meal of monkey chow every day for a year (Bremer et al., 2011). By the end of the study, every single monkey had developed insulin resistance and four even became diabetic (Bremer et al., 2011). Researchers have generated similar findings in human studies without going so far as to cause lasting damage (Tappy & Lê, 2010). For example, a study on non-diet soda consumption concluded that for each additional soda one consumes, obesity risk increases 1.6 times (Ludwig et al., 2001). Plenty of similar studies on both human and animal subjects exist and provide additional evidence for the argument on sugar as a factor in chronic disease; however, the matter remains controversial because every study falls short of being conclusive in one way or another. For instance, animal studies are instructive and noteworthy, but their findings are not necessarily applicable to humans, and equivalent studies on humans are unethical and therefore prohibited. Moreover, in order to expedite the study, oftentimes researchers feed their study subjects unrealistic quantities or concentrations of sugar, so the results may not apply to real-world sugar consumption (Tappy & Lê, 2010). The list of limitations surrounding these research studies never ends, so they fail to provide a definite conclusion, but they do suggest a *probable* conclusion– that sugar is, in fact, the logical culprit.

Further evidence supporting that conclusion is the repeated simultaneity with which chronic disease follows short behind Westernization and increased sugar intake. Physicians and researchers have observed this association between increased sugar intake and an upsurge in chronic disease time and time again throughout the world in populations with extremely diverse historical backgrounds; regardless of when or where Westernization occurs, heightened sugar consumption is a part of the process and chronic disease appears to be a result (Taubes, 2016, p.

153). Along with an increase in sugar intake, most Westernized populations experience various other dietary changes as well, such as increased consumption of animal products or fat; however, "by far the most significant and consistent change in human diets as populations become Westernized…is how much sugar they consume" (Taubes, 2016, p. 153). Every time this dietary change occurs throughout a population, decades later, all the diseases associated with sugar begin to emerge (West, 1974).

The United States

This progression from Westernization to chronic disease took place throughout the U.S. beginning in the late nineteenth century as sugar consumption exploded with the industrial revolution (Taubes, 2016, p. 13). The first noticeable health condition to appear in the sugar-related disease progression is insulin resistance or diabetes, so–to illustrate sugar's link to Western disease overall–the thesis will focus primarily on the spread of diabetes in particular. Until the latter half of the 1800s, diabetes in the U.S. was rare–it had been documented in medical texts and journal articles but was rarely seen by physicians (Vaughan, 1818). By the 1870s, however, the epidemic had begun, and between 1870 and 1890 the country's mortality rate from type 2 diabetes doubled; then it doubled yet again by 1900 (Osler, 1909, p. 409). For the past century, diabetes has only become more and more widespread and common throughout the population; from the 1960s to today, it has increased in prevalence by 900% (Tabues, 2016, p. 212). Shortly after the diabetes epidemic set in, all the accompanying diseases and complications–heart disease, hypertension, obesity, gout, kidney disease, etc.–began to rise in prevalence as well, and those diseases, too, have only become more and more common since (Taubes, 2016, p. 20). As Western physicians and researchers began to notice this trend, they

became curious as to its root cause; it was obvious that some element of Western lifestyle and diet was causing these health issues, but what was it, exactly (West, 1974)? To find the answer, they studied various other populations across the globe as they made the transition to more affluent, urban life.

Native American Populations

One such population of interest was the Native Americans living in the western United States, as they did not adopt the Western diet and lifestyle of the east until later–around the mid twentieth century (Russell, 1975). Researchers focused their studies on the Native Americans of Arizona–specifically the Pima, living in the south-central portion of the state–because until the mid 1900s, diabetes was especially uncommon in this state (Joslin, 1940). In 1940, approximately three to four in every one thousand Pima suffered from diabetes (Joslin, 1940). They had subsisted on whole, natural foods that they hunted and farmed until the early 1900s when they began to receive government rations and gain access to the industrial, processed foods of the "white man" (Russell, 1975). However, it was not until World War II–when the Pima were drafted into the military and recruited to work factory jobs in war-related industries–that they began the full integration process into "white society" (Russell, 1975). About a decade following this full integration, diabetes began to increase in prevalence, but by the 1960s it was a full-blown epidemic (Bennett et al., 1971). In 1963, blood samples were taken from over 900 Pima to be studied, and diabetic blood sugar levels were found in 30% of them (Bennett et al., 1971). Moreover, among the Pima over 30 within the study, one of every two was an undiagnosed diabetic (Bennett et al., 1971). This record high diabetes rate was not only present amongst the Pima, but other Native American populations in the surrounding area as well; by the 1980s,

researchers had documented an extremely high prevalence of both diabetes and obesity in Native American tribes throughout Arizona, Utah, and New Mexico, and diabetes was a primary cause of death for these populations (Gohdes, 1986). Although the Native Americans' transition to a Western diet entailed both increased sugar and fat consumption–and so it was unclear which of the two might have caused the chronic disease that came along with them–this was not the case for all Westernized populations (Byers, 1992, p. 285-6).

Tokelau

The Tokelauans, for example, consumed much more fat before they became Westernized than after, but they, too, experienced a similar upsurge in chronic disease as a result of the shift (Prior et al., 1974). Tokelau is an island nation in the South Pacific and a protectorate of New Zealand; in the 1960s, as the Tokelauan population grew to the islands' capacity, the New Zealand government began a voluntary migration program to the mainland (Wessen et al., 1992). As New Zealanders were living much more modern, urban lifestyles than the islanders, with this migration came Westernization, so researchers studied both the migrants and the Tokelauans who stayed on the island with the hope of better understanding the progression of Western disease (Wessen et al., 1992). On the island, the Tokelauans subsisted on a diet of whole, natural foods, but they consumed one of the highest fat concentrations of any population in the world at the time, with more than 50% of their calories coming from fat (Prior et al., 1974). The majority of this fat content was saturated fat that came from coconuts, as this fruit was a main source of energy for the islanders (Prior et al., 1974). They consumed relatively little sugar before integrating into Western society; as of 1968, when Westernization of the island was in its early stages, the islanders were still consuming less than eight pounds of sugar per person per year,

which equates to about 2% of their total calories (Prior et al., 1974). Not surprisingly, chronic disease associated with sugar consumption was rare; there were some documented cases of diabetes and gout but their prevalence was insignificant in comparison to concurrent U.S. rates (Wessen et al., 1992, p. 13). Then, as Tokelauan Westernization progressed on both the islands and the mainland throughout the 1970s, their sugar intake shot up dramatically; by 1982 per capita sugar consumption had jumped to 54 pounds per year (Wessen et al., 1992, p. 288-89). Fat consumption decreased at this time as well, as other food sources from the mainland replaced coconuts in the islanders' diets (Wessen et al., 1992, p. 288-89). Dietary and lifestyle changes occurred more quickly and more dramatically for the migrant Tokelauans, and so did the development of Western disease (Wessen et al., 1992, p. 291-96). Diabetes, obesity, heart disease, hypertension, and gout prevalence shot up in both the migrant Tokelauans and those who remained on the island, but the upsurge was more evident among the migrants (Østbye et al., 1989). By 1982, one in every five female migrants and one in every nine male migrants were diabetic; moreover, their average weight had increased by approximately twenty five pounds (Østbye et al., 1989). Although the Tokelauan Westernization story is compelling evidence for sugar as an agent of Western disease as opposed to fat, there were certainly additional factors that could have played a role in the progression toward disease (Wessen et al., 1992, p. 288-89). With Westernization and increased sugar intake, also came increased alcohol consumption, cigarette smoking, and meat consumption, so, like the study on the Pima, this case also fails to unquestionably incriminate sugar as the cause of Western disease (Wessen et al., 1992, p. 288-89). However, it does add yet another example to the abundance of evidence pointing toward this conclusion.

Two other studies–conducted with Jews from Yemen who migrated to Israel in the first half of the twentieth century and with Indian immigrants living and working on sugar plantations in South Africa–exhibit identical results: as these populations changed their diets and lifestyles, they ate more sugar, and chronic disease exploded among them (Cohen et al., 1961 & Campbell, 1963). In all these examples, there are various additional aspects of change that certainly could have–and likely did–play a part in causing the disease that manifested; however, the most strikingly consistent change across each of these stories is an increase in sugar consumption. It just *makes sense* to blame sugar for the afflictions that came along with Westernization and seem to worsen as civilizations progress. Chapter Three elaborates on the intensification of Western disease that has occurred since its arrival in depicting the nation's current state of health–or rather, the lack thereof.

Chapter Three: The Health of The Nation

The Obesity Epidemic and Chronic Disease

Chronic diseases and health conditions associated with sugar consumption have recently become extremely widespread and detrimental to the U.S. nation both medically and financially.

Until the early 20th century, the country's primary public health concern was infectious disease; a lack of basic sanitation fostered the spread of these diseases, and limited access to calorie-rich, nutrient-dense foods heightened their severity (Winson, 2014, p. 39). Infectious–not chronic–disease was the principal cause of morbidly and mortality (Winson, 2014, p. 39). However, as the country has progressed in its fight against these illnesses through improved sanitation, medicine, and access to food and water, chronic disease has taken over as the main factor in U.S. morbidity and mortality (National Center for Health Statistics, 2017). Chronic disease is now the leading cause of death in the US; it was responsible for over 60% of deaths in 2016 (the most recent year for which statistics are currently available) (National Center for Health Statistics, 2017).

Chronic disease has become such a widespread, common problem for a variety of known and unknown reasons, but health and nutrition experts are certain that obesity plays some role Institute of Medicine of the National Academies, 2012, p. ix). Some argue that obesity is currently the nation's most significant public health challenge because of the ripple effects it seems to have on the development of chronic disease and because of its prevalence (Institute of Medicine of the National Academies, 2012, p. ix). As of 2016, approximately 40% of adults and 19% of children in the U.S. were obese (Hales et al., 2017). These are the most recent statistics available , and they represent the highest percentages ever recorded (Hales et al., 2017).

Moreover, more than 66% of adults and 33% of children are either overweight or obese (Flegal et al., 2010 & Ogden et al., 2010). U.S. obesity rates have been steadily rising since the 1980s, and they continue to do so despite public health efforts to curb the epidemic (Hales et al., 2017).

Presently, the most fatal chronic disease correlated with obesity is heart disease; it is currently the leading cause of premature death in the U.S. and was responsible for almost a fourth of all deaths in 2016 (National Center for Health Statistics, 2017). Every minute, more than one person in the U.S. dies due to heart disease (National Center for Health Statistics, 2017). Cancer, another obesity-related affliction–is almost equally widespread and lethal; it was responsible for just over a fifth of all deaths in 2016 (National Center for Health Statistics, 2017). Diabetes–another disease closely related to obesity–is not quite as deadly; however, it severely complicates its victim's lives, and it afflicts a significant portion of the U.S. population (Bullard et al., 2018). In 2015, the latest year for which the Centers for Disease Control has provided reports, 100 million U.S. adults had either diabetes or pre-diabetes, and type 2 diabetes–the form linked to diet and obesity–accounted for 90% to 95% of all diabetes cases (National Center for Chronic Disease Prevention and Health Promotion, 2017). Of that 100 million, approximately 30.3 million adults had diabetes, which is about 10% of the population, and 84.1 million adults had pre-diabetes, which is likely to lead to type 2 diabetes within five years (National Center for Chronic Disease Prevention and Health Promotion, 2017). Diabetes was the seventh leading cause of death in 2015 (National Center for Health Statistics, 2017). As explained in Chapter Two, the collection of conditions known as metabolic syndrome is the precursor for both type 2 diabetes and heart disease, and in 2016, an estimated 75 million U.S. adults–almost a quarter of the entire population–had metabolic syndrome (Ervin, 2009). Although gout is much less

prevalent than the other conditions mentioned here, it is noteworthy because its prevalence has been steadily increasing for the past half century, and it is now more common than ever before (Chen-Xu et al., 2019). Cases of gout more than doubled from the 1960s to the 1990s and have only grown since then (Zhu et al., 2018). The most recent data obtained indicates that about 5% of men and 3% of women over the age of 20 currently have gout (Chen-Xu et al., 2019). This disease is less widespread and more treatable than the others, so it receives less media attention, but its expanding presence is still significant in illustrating the effects of excess sugar consumption (Zhu et al., 2011; Reaven, 1997; Mayes, 1993).

The Financial Implications of Disease

These chronic diseases are clearly devastating in terms of their impact on the nation's health, but they are also incredibly costly. An estimated 75% of all U.S. health care dollars are spent annually treating diseases associated with metabolic syndrome (a broad category encompassing a variety of cardiovascular diseases and abnormalities) (Anderson, 2004). A more recent study from 2016 estimated that obesity in particular costs the U.S. $149 billion in medical expenses annually, and obese individuals have medical costs that are 42% higher on average than healthy weight individuals (Kim & Basu, 2016 & Finkelstein et al., 2009). The indirect, non-medical costs associated with obesity also reach the billions; these include missed time at work or school, lower productivity in the workplace, increased transportation costs, and decreased military readiness; weight is now the most common reason young adults are ineligible to serve in the military (Trust for America's Health, 2018, p. 13). These costs are high already and are projected to increase in the upcoming decade; according to the American Heart Association, the

cost of cardiovascular disease is expected to triple by 2030 to reach $800 billion annually (Heidenreich et al., 2011).

Every year, the U.S. spends outrageous sums of money and loses millions of valuable lives because of the obesity epidemic and the chronic disease associated with it; if by making changes to the nation's diet, these unfortunate expenditures and losses can be prevented, or at least mitigated, why have these changes not come about already? The next two chapters will discuss the wide array of reasons why decreasing the nation's sugar consumption is such a challenge.

Chapter Four: Why Is Sugar Free From Blame?

Although the majority of U.S. health authorities today recognize excess sugar consumption's potential causal link to chronic disease, they have not always. The idea that sugar intake is detrimental to the population's health was not well known or accepted by U.S. health experts until rather recently (Mann, 2003, p. 552). Instead, throughout the bulk of diet and disease research history, experts remained focused on other diet-related factors–such as general overconsumption and dietary fat–as sources of chronic disease (Mann, 2003, p. 552). Even though a vast body of evidence now exists suggesting that sugar does, in fact, cause disease, this assertion still cannot be made with complete certainty; the sugar/disease link is still a matter of debate. Chapter Four explains how diet and disease research history has played a vital role in exonerating sugar as a potential source of disease, and it describes the complexity behind proving that sugar is to blame.

A History of Exonerating Sugar

The Energy Balance Hypothesis

The science of nutrition emerged as an "official discipline" in the 1860s when German researchers discovered a method to precisely measure energy content in food and energy expenditure as a result of physical activity: they invented the first calorimeter (Atwater, 1888, p. 257). In the half-century that followed this invention, nutrition researchers measured people's energy requirements depending on age and activity level, they studied which macronutrients, vitamins, and minerals were necessary to maintain a healthy diet, and they investigated what the consequences were if these needs were not met (Atwater, 1888, p. 257). However, their principal

focus was energy intake and expenditure because these were the things they could actually measure (Karolinska Institute, 1977). It was not until about a century later, in 1960, that it became possible to measure hormone levels in circulation and researchers began to understand how the human body reacts to different types of foods and macronutrients (Karolinska Institute, 1977). Until then, researchers thought about diet primarily in terms of its impact on "energy balance."

Because researchers fixated on the notion of food as energy–rather than considering that different foods might impact the human body in utterly different ways–physicians perceived food this way as well (Newburgh &Johnston, 1930). Therefore, both researchers studying obesity and physicians treating it assumed that overindulgence and insufficient activity must cause this condition and the diseases associated with it (Newburgh & Johnston, 1930). There was some skepticism surrounding this theory, however. While U.S. researchers never doubted it, some European researchers rejected this energy balance explanation on account of the fact that men and women accumulate fat differently–in different bodily regions and at different times in their lives–even if they both consistently consume more energy than they expend (Baur, 1941). If fat accumulation were simply a matter of eating more than you burn, one's gender would not impact this process. Moreover, the tendency to accumulate fat and to gain it in certain areas is genetic, so the skeptics concluded that some additional factor must play a role, something besides gluttony and sloth (Baur, 1941). In the 1920s and 30s, these progressive European researchers began considering the idea that hormones may regulate fat accumulation in some way, but it was not until the 1940s that this hypothesis was refined and widely accepted in the European medical research community (Rony, 1940, p. 173-74). By this time, U.S. researchers and physicians were

fully convinced that obesity was simply the result of overconsumption, and to propose otherwise was quackery (Anon, 1955, p. 111-25). After World War II and the devastation it caused in Europe, the U.S. took over as the leader in medical research, and with this shift, the support behind the hormone hypothesis dissolved (Anon, 1955, p. 111-25). Even as knowledge about hormones and how they function accumulated and disseminated throughout the second half of the century, those studying and treating obesity stuck to the energy balance idea as the fundamental factor involved; it had been so ingrained as fact in their minds that questioning it was unthinkable (Anon, 1955, p. 111-25).

This ninety-year head start that the concept of energy balance had on the exploration of the endocrine system has greatly impacted the path that nutrition science has taken, and it still affects the discipline today (Karolinska Institute, 1977). Even though it is now understood and accepted that hormones and enzymes regulate how the body uses food so that different foods are metabolized differently, those studying and treating obesity often ignore this information and revert back to the energy-balance-focused view of diet instead. In a 2013 report detailing "Current Evidence on Healthy Eating," for example, its authors (professors of nutrition and epidemiology at Harvard) claim that "excess adiposity, due to an imbalance between energy intake and expenditure is the most important nutritional problem in developed countries" (Willett & Stampfer, 2013, p. 78). In making this assertion, they reinforce the inaccurate, old-school mantra that "a calorie is a calorie"–whether it comes from an apple or a candy bar–and that, in order to treat obesity, you must simply eat less. They discredit the fact that much more than just calories in food influences whether or not it contributes to fat accumulation. This conventional, yet faulty, view of diet fails to acknowledge the uniquely harmful effects that excess sugar can

have, so the sugar industry loves it. The industry has taken hold of this claim–that all calories are created equal–and used it to defend its product for about a century now (Taubes, 2016, p. 122). In the 1950s, the sugar industry ran a $750,000 advertising campaign based entirely off of this notion, and about sixty years later in 2015, Coca-Cola began funding a "Global Energy Balance Network"–an organization of researchers recruited to "bring science to bear on the awareness for an energy balance-based solution" to obesity (Borders, 1965 & O'Connor, 2015). Despite its blatant flaws and shortcomings, the energy balance idea has maintained its strong hold on nutrition science throughout the years thanks to significant support from the sugar industry.

Sugar As Empty Calories

Another dietary perspective that frees sugar from the suspicion it deserves is the perspective that discourages consuming sugar because it contains little nutritional value. Nutrition authorities frequently refer to added sugar as "empty calories" and discourage its consumption for this reason–because it lacks essential vitamins and nutrients and takes the place of foods that contain them in people's diets (Taubes, 2016, p. 15 and Update of the Healthy Eating Index, 2013). This assertion on added sugar is not untrue; however, condemning sugar for this reason alone lets it off the hook completely. Like the energy balance idea, it ignores the fact that the body appears to react to excess sugar in a distinct manner that provokes insulin resistance and chronic disease. This view of diet is certainly an improvement from that which focuses on energy balance–at least it acknowledges that there is more to food than calories–but it is still incomplete and misleading regarding the impact of excess sugar.

Blaming Fat Instead

Yet another misconception that has functioned historically to exonerate sugar is that dietary fat (not sugar) is to blame for insulin resistance and the chronic disease it causes. Two prominent researchers, Elliot Joslin and Harold Himsworth, devoted their careers to studying insulin resistance and diabetes throughout the twentieth century, and their convictions heavily shaped the future of diabetes research that was to come (Joslin, 1916, p. 2033-38 & Himsworth, 1949, p. 465-73). Both Joslin and Himsworth blamed obesity (i.e. overconsumption) and dietary fat as the cause of type 2 diabetes (Joslin, 1916, p. 2033-38 & Himsworth, 1949, p. 465-73). They reasoned that, because excess fat accumulation in the body and blood is associated with diabetes, it was only logical that excess fat from an individual's diet would provoke these conditions (Joslin, 1927, p. 1063 & Himsworth, 1949). They cited example after example in which high or increased dietary fat intake precipitated the disease; however, high or increased sugar intake was always evident in these examples as well (Joslin, 1917 & Himsworth, 1949). Joslin and Himsworth paid no attention to sugar, though, because they presumed that the body responds to all carbohydrates–grains, starch, sugars–in the same way, and they noted that high overall carbohydrate intake seemed harmless (Joslin, 1917 & Himsworth, 1949). They cited the Japanese, who consumed an abundance of carbohydrates and had strikingly low diabetes rates, as evidence that carbohydrate consumption must not cause diabetes (Joslin, 1917 & Himsworth, 1949). Because they considered all carbohydrates the same, this case exonerated sugar for them as well (Joslin, 1917 & Himsworth, 1949). In addition to this blatant error, there were other flaws in their research and analysis, but because they were some of the only legitimate authorities on diabetes at the time, no one doubted their work (Taubes, 2016, p. 101). Therefore, over time, it

became fact that dietary fat caused diabetes, not sugar. The idea that perhaps sugar *does* promote diabetes was finally revisited by U.S. health experts in the 1970s, but by this time, it was common knowledge that dietary fat was to blame for diabetes and the conditions linked to it (Marble et al., 1971). At a time when the dietary fat/disease hypothesis was still in its infancy, the media took it as fact and blasted it (Marble et al., 1971).

Throughout the second half of the twentieth century, public health authorities urged Americans to consume low fat diets, and with a newfound interest in health motivated by a fear of chronic disease, the public obliged (Walker, 1959). This low-fat campaign prompted the processed food industry to decrease the fat content of their products, but in order to do so and preserve taste quality, they added more sugar instead (O'Connor, 2016). As a result, this low-fat diet that dominated the U.S. throughout the late twentieth century often consisted of processed foods with record high sugar contents (O'Connor, 2016). Some experts now blame this diet movement for transforming the obesity epidemic into the crisis it is today; however, at the time, health authorities were entirely unaware of the damage they were causing (O'Connor, 2016). They genuinely believed fat–not sugar–was to blame for the diseases devastating the U.S. population, so they devoted themselves to decreasing the nation's fat consumption (Taubes, 2016, p. 195). In 1984, the National Institutes of Health spent hundreds of millions of dollars on an enormous public relations campaign stressing the importance of a low-fat diet (Marshall, 1990). The American Heart Association promoted decreased fat intake as well; they gave "healthy heart checks" to products low in fat (but often very high in sugar) to show consumers their support for these foods (Squire, 1988, p. 9). From its origin as a flawed hypothesis

championed by a small handful of influential "experts," the low-fat solution to obesity and disease captivated the country and took over as the health movement of the twentieth century.

While most U.S. health authorities were convinced that fat caused disease, European nutrition and disease researchers were skeptical of the hypothesis all along and for good reason (Dickson, 1964, 361). As the low-fat diet gained recognition and popularity, researchers conducted several tests to determine its efficacy in reducing disease risk (Dickson, 1964, 361). In trial after trial, the low-fat diet proved ineffective in producing the positive health benefits expected of it (Dickson, 1964, 361). Moreover, the French diet specifically was notably high in fat, but as a population, they had relatively low rates of heart disease (Huets de Lemps, 1999, p. 383-93). On a similar note, various populations–such as the Masai in Kenya, the Inuit, and the Tokelauans–actually consumed *less* dietary fat as a result of the Westernization of their diet, and yet, Western disease still emerged within years of their transitions (Himsworth, 1935 & Prior et al., 1974). This evidence disproving the link between dietary fat and disease was all available by the late twentieth century, but because it was scattered throughout the globe and written in a variety of languages, U.S. researchers did not understand the extent of it (Himsworth, 1935). They assumed whichever exceptions they did know about were simply inexplicable paradoxes (Himsworth, 1935). The idea that dietary fat might actually be harmless was uncommon and unpopular, therefore unattended to by the majority (Taubes, 2016, p. 163-4).

The Industry's Role in Exonerating Sugar

The sugar industry used this condemnation of dietary fat to their advantage, and in doing so, they succeeded in turning attention away from their product until the turn of the century. In 1943, the sugar industry formed a nonprofit organization called the Sugar Research Foundation

(later known as the Sugar Association); its members' focus would be educating the public and funding research to "secure all known facts about sugar and its effects on and need by the human system" (Lamborn, 1942). In the 1940s and 50s, the Sugar Research Foundation funded U.S. nutritionist Ancel Keys' research arguing that dietary fat caused heart disease due to its tendency to increase blood cholesterol (SRF, 1945). Keys' well-renowned, influential publications linking dietary fat and disease shaped nutrition research throughout the remainder of the century (SRF, 1945). Later in the 1960s, the Sugar Research Foundation paid three Harvard scientists today's equivalent of $50,000 to conduct a study that would downplay the link between sugar and chronic disease and identify saturated fat as the culprit instead (O'Connor, 2016). They published a review on this study in the New England Journal of Medicine, and with it, they succeeded in exonerating their sponsor's product for decades (O'Connor, 2016). One of the three scientists went on to become the Head of Nutrition at the U.S. Department of Agriculture and played a significant role in promoting the low-fat diet movement as well (O'Connor, 2016). Although the sugar industry was not entirely responsible for the dietary fat/disease hypothesis, they certainly did their part in promoting it.

Shifting the blame to fat was not the industry's only strategy, though; the sugar industry took advantage of every argument and opportunity they could to defend their product against criticism. In the early 1950s, the Sugar Refining Company launched an advertising campaign stressing the importance of sugar in children's diets because of the energy it provided their growing bodies (Anon, 1951). Later in the 50s, the Sugar Association funded a $1.8 million "educational" campaign to inform the public that obesity is caused by overconsumption, which is caused by hunger, which is a response to low blood sugar, which sugar consumption can remedy

(Anon, 1954). They then advertised their product as the most effective way to stave off hunger and, therefore, prevent obesity (Anon, 1954). The industry's most successful campaign came about two decades later in the 1970s. Instead of illustrating some benefit sugar could provide, this campaign simply emphasized the "safety" of sugar–that eating it would not produce any harmful health effects (SAI, 1976). During the 1970s, sugar's potential link to disease was called back into question, and this campaign was the industry's response to this threat (Taubes, 2016, p. 171). Their response was a successful one: the campaign convinced the American Heart Association and the American Diabetes Association to approve sugar as part of a healthy diet, which led the FDA to recognize sugar as "generally regarded as safe" (GRAS) (Rolnik, 2016 & Sit et al, 1977, p. 2534). The public relations firm in charge of this campaign won the most prestigious honor in the PR industry for this work (SAI, 1976). Prior to this publication by the FDA, while members reviewed the research regarding sugar's safety, the International Sugar Research Foundation hosted a conference on the matter in Washington D.C. but only invited experts who were skeptical of the link between sugar and disease (Select Committee, 1977). These examples represent just a small percentage of the efforts the sugar industry has put forth to secure sugar's place in the nation's diet; Chapter Five delves deeper into the sugar industry's power and influence.

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With the help of the energy-balance-focused view of food, the lack of attention paid to the endocrine system's role in digestion, the condemnation of fat, and, of course, the sugar industry, sugar has escaped the scrutiny it deserves and has maintained its reputation as practically harmless throughout the bulk of its history.

Research Linking Sugar and Chronic Disease and The Lack Thereof

A minority of researchers and experts remained skeptical of sugar's safety all along, but that skepticism has recently spread to reach the majority and transferred into mainstream dietary advice (Mann, 2003, p. 552). Now most legitimate health authorities *do* recognize sugar as a potential cause of obesity, diabetes, and heart disease and recommend restricting its consumption as a result (AHA, 2018; WHO, 2018; HHS & USDA, 2015). A multitude of compelling studies conducted since the turn of the century have spurred this shift in attitudes regarding sugar's link to disease. For example, one study published in 2014 by the American Medical Association observed a "significant relationship" between added sugar intake and cardiovascular disease mortality among U.S. adults (Yang et al., 2014, p. 516). The Nutrition and Chronic Diseases Expert Group arrived at similar conclusions from their 2017 study: they found that sugar-sweetened beverages (the most highly concentrated source of sugar in the nation's diet) in particular are strongly tied to disease; therefore, they concluded that sugar must have etiologic effects (Micha et al., 2017, p. 1-2). Hundreds of studies like these exist, and because of this growing body of evidence illustrating the negative effects of sugar intake, organizations like the American Heart Association and the World Health Organization now place historically stringent restrictions on sugar consumption (AHA, 2018 & WHO, 2018).

While clear progress has been made, sugar's role in causing disease remains a point of contention: the FDA still lists sugar as "generally regarded as safe," and a collection of health authorities still do not recommend an upper limit for its consumption (FDA, 2019 & Mann, 2003, p. 552). Even though an abundance of studies exist that come close to proving sugar's harmful effects, these studies all have their limitations, which allow those in favor of sugar (like

the sugar industry and its countless allies) to discount their findings as inconclusive (Nestle, 2012, p. 419). Factors that cast doubt upon nutrition research studies–like those on sugar and disease–include genetic variation within the human race, the vast complexity surrounding dietary intake, probable errors in self-reported data, behavioral and lifestyle variability, and the simple fact that correlation does not entail causation. Moreover, the sugar/disease link is extremely challenging to study given the lengthy incubation period for chronic disease, the ethicality surrounding human studies, and the endless list of uncontrolled variables involved. For these reasons and more, it is essentially impossible to establish–without any discernible, remnant doubt–that sugar *indubitably* does generate chronic disease.

The inability to prove sugar's harmful qualities and history's exoneration of sugar partially explain why sugar has become and remains such an unavoidable staple in the U.S. diet despite its apparent toxicity; however, there are certainly additional factors at play here. Chapter Five explains these various additional factors perpetuating sugar's prevalence.

Chapter Five: The Trap

Despite the vast array of evidence that now exists linking sugar to disease, the U.S. population cannot seem to escape sugar. Due to people's taste and appreciation for sugar-filled products, the money and power behind the companies that support the sugar industry, aggressive advertising promoting these products, and the sugar industry's political influence, the U.S. is now trapped consuming exorbitantly high amounts of the sweet commodity. Excess sugar is practically unavoidable in modern U.S. food environments, and this chapter details precisely why this is the case.

As the majority of U.S. sugar intake comes from added sugar found within highly processed food and beverage products–"pseudo foods," as Winson nicknamed them–sugar's prevalence is a product of the success of the highly processed food and beverage industry (Winson, 2014, p. 25). Therefore, in explaining the sugar trap the U.S. is currently caught within, this chapter frequently references the efforts of the pseudo food industry and the prevalence of its products, rather than those of the sugar industry itself. But again, because sugar sales depend on highly processed food and beverage sales, the success of this pseudo food industry translates to success for the sugar industry as well.

Consumer Preference

Taste

Arguably the most powerful factor securing sugar's place in the country's diet is its popularity; sugar is tasty and even addictive, it seems, so consumers have no desire to give it up (Avena, Rada, & Hoebel, 2008). Within the past decade or so, an interest in health and fitness has

become more common and mainstream, so a significant band of health-conscious consumers–who actively strive to reduce their sugar consumption–does exist in the U.S. today (Nestle, 2012, p. 411-412). These consumers read food labels, actively pursue products without added sugar (which are more difficult to find than they should be), and aim to choose less processed or whole foods when they can. However, these consumers do not represent the majority; the majority is either unaware of the damaging effects of excess sugar, or their concern regarding this potential damage is not severe enough to motivate them to modify their diet (Cluss et al., 2013; Carbone et al., 2012; Haspel, 2016). The majority upholds the high demand for sugar within the U.S. food system because they *like* it, which comes at no surprise given the fact that the human body is designed to derive pleasure from sweet foods; this preference is innate (Drewnowski, Mennella, Johnson, & Bellisle, 2012). People's preference for sweetness is so strong, that researchers often compare it to an addiction. As explained in Chapter Two, neural reactions to sugar are extremely similar to those to addictive drugs, so it makes sense that, given the option, most consumers choose to eat sugar rather than avoid it (Drewnowski, Mennella, Johnson, & Bellisle, 2012). Moreover, now that food producers add sugar to the majority of processed food products available, consumers are accustomed to eating it in excess on a regular basis, and as a result, natural foods and even unsweetened processed foods taste bland and unsatisfactory (Moss, 2013, p. 19). If highly processed food manufacturers remove or reduce the added sugar in their products, demand for them decreases, and they are unable to compete (Moss, 2013, p. 19). The majority chooses foods with added sugar over those without simply because they taste better–so much better that they generate something like an addiction.

Convenience

The preference for these products comes not only from their taste, though; consumers also prefer highly processed foods with generous sugar contents because they are typically more convenient, cheaper, and more widely available than less processed foods or foods made from whole, natural ingredients. As detailed in Chapter One, a wide variety of highly processed foods available today contain added sugar, and these products are often precooked or preprepared; they are "ready-to-eat" as they come. Consumer's often select these sugar laden products over raw ingredients for this very reason–because they save time and effort; they are significantly more convenient.

Cost

These ready-to-eat, sugary food products are also generally much cheaper than whole, natural foods and healthier processed options. Processed foods are so much cheaper than whole foods because the steps required to make high-quality, fresh, whole foods available (careful preservation, refrigeration, etc.) are much more costly than those involved in making processed packaged foods available (Inskeep, 2013). Moreover, government subsidies decrease the cost of producing highly processed foods–funding the production of their key ingredients (sugar, corn, beef, etc.)–so these products can be sold for even less (Inskeep, 2013). In addition to that government assistance, the artificial, chemical ingredients so often infused into these processed products to enhance their taste are already much cheaper than natural food ingredients that might serve this goal (Inskeep, 2013). So, for these reasons, processed food producers can afford to sell their products at significantly lower prices than those selling whole foods, further motivating consumers to prefer processed options.

Availability

One last factor driving consumers' tendency to choose highly processed foods–often filled with excess sugar–over whole foods is the fact that these pseudo foods are more easily accessible. Highly processed food products are typically those that occupy the prime real estate within a supermarket (the center aisles, the stand-alone, eye-catching displays, the aisle ends, the shelves near the checkout counters), so they attract customers. Similarly, the huge restaurant chains that utilize processed food ingredients now dominate the prime real estate throughout the country (Winson, 2014, p. 222). As a result, processed food products and ingredients are everywhere–high traffic areas, suburbs, malls, schools, hospitals, airports, gas stations, convenience stores–which certainly cannot be said for healthier, whole food options. Due to this heightened availability, the average consumer opts for processed foods the majority of the time. Some consumers do not even have a choice, though: processed food products and ingredients control the industry to such an extreme extent, that whole food products and ingredients are hardly available at all in certain parts of the U.S. (Epidemiology and Genomics Research Program, 2015). If the amount of consumers that can afford the higher prices for whole, natural foods is not sufficient in a given geographic sector, suppliers cannot afford to make them available there (Inskeep, 2013). Consumers so often choose these damaging processed food options because they are within reach, and healthier foods are not.

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In sum, consumers favor sugary processed foods due to their taste, convenience, lower cost, and increased availability, and this consumer preference enables pseudo food producers to maintain and further their enormous success in the U.S. food industry.

Money and Power Behind the Highly Processed Food Industry

This great success enjoyed by the pseudo food industry stems from the fact that their products are differentiable and profitable. Government subsidies enhance this profitability in that they drive down the costs of key ingredients within these highly processed foods, but these products are also inherently profitable in that they contain "added value," whereas natural, whole foods and minimally processed commodity products (flour, milk, coffee, etc.) do not (Winson, 2014, p. 191). Highly processed food producers make their products uniquely valuable providing distinctive food items that no other company has (Oreos, Cheerios, and Pringles, for example), fortifying them with "added vitamins and nutrients," and presenting them in a special and enticing manner (through food dyes, unique shapes, packaging, etc.). This concept of adding value allows for product differentiation, which results in better-than-average returns (Winson, 2014, p. 191). Producers of whole, natural foods and minimally processed commodities lack the ability to differentiate their products to this extent because of the nature of these items. Due to this lack of added value, however, commodity products have thin profit margins and their producers have little room for growth (Winson, 2014, p. 191). As a result, the highly processed food producers tower over those selling commodity food products in terms of their financial success and resulting power.

Another significant factor in this success and power is these firms' price-setting ability. The highly processed food industry is heavily concentrated and has been for decades; only a handful of players exist within each product market (Scherer, 1982, p. 195). Therefore, these firms make up an oligopoly and enjoy the price-setting power that is supposedly absent with a free market economy (Scherer, 1982, p. 195). Taking the market for breakfast cereal for example,

just four companies–Kellog's, General Mills, General Foods, and Quaker Oats–have dominated the market since the late 1900s; by 1970 they controlled 91% sales (Scherer, 1982, p. 195). Throughout the five year period from 1965 through 1970, the Kellog's company–the most powerful firm of the four–led twelve of fifteen seemingly arbitrary price increases, and its competitors all followed to attain successively higher and higher prices for their products (Scherer, 1982, p. 195). This behavior is evident across product markets throughout the entire highly processed food industry (Winson, 2014, p. 193). There exists some price leader within each product category, which initiates the price increase, the leader's competition follows close behind increasing their prices as well, and as a result, all the firms within the oligopoly completely control the price they require from consumers.

The money and power behind the highly processed food industry secures sugar its position in the U.S. food economy and, therefore, the population's diet.

Industry Advertising

The fact that it sells unique, differentiated products has granted the highly processed food industry the ability to advertise, the money and power behind them has allowed them to do so on a massive scale, and the intense competition within the industry has made that necessary. Advertisements promoting these highly processed foods are ubiquitous. As the variety of media channels available has expanded over time, advertising in general has become increasingly intensive and incessant, and the food industry has certainly capitalized on this opportunity and played a significant role in the proliferation of advertising (Kotz & Story, 1994, p. 1296-1300). Food producers advertise their products everywhere–television, radio, magazines, event spaces,

the internet, movies, the list goes on–and they spend tremendous sums of money doing so. The vast majority of food industry advertising money is spent on the highly processed food products that are differentiable and most profitable–and also so often infused with unnecessary added sugar (Kotz & Story, 1994, p. 1296-1300). Marion Nestle estimated that by the year 2000, of the $33 billion food companies spent promoting their products, approximately 70% was spent on candy and snacks, convenience foods, alcoholic beverages, desserts, and soft drinks, while just about 2% was spent on fruits, vegetables, grains, and beans (p. 22 & Gallo, 1999). The advertising presence of these highly processed food products is not even comparable to that of commodity food products or whole, natural foods, and this is yet another reason for these pseudo foods' continued success despite their potentially damaging effects.

These companies actually utilize advertising to downplay these potential negative health impacts associated with their products, promoting the message that healthy diets are flexible and every food is acceptable when consumed in moderation (SAI, 2019 & NAMI, 2019). Even though there now exists an abundance of evidence suggesting that certain foods–such as those with added sugar–are harmful, companies selling these questionable highly processed food products completely ignore this evidence and support the old-school mantra of "everything in moderation." The Sugar Association–the "scientific voice of the U.S. sugar industry–illustrates this advertising trend perfectly with an entire page devoted to "sugar in moderation" on its website (SAI, 2019). This "anything goes" message leaves the public confused and utterly unclear about what a healthy diet does and does not entail. This public confusion is beneficial to these pseudo food producers, though, in that their consumers consider nothing entirely off-limits and continue consuming their products. Confusing the public is these companies' *goal* because it

succeeds in de-stigmatizing their products and maintaining their place in the U.S. food economy and in consumers' kitchens (Nestle, 2012, p. 17).

The highly processed food industry utilizes its immense advertising presence to promote its products directly and to maintain widespread confusion regarding health and nutrition among the U.S. public, thereby generating support for their products indirectly as well. This direct and indirect promotion forms the thorough and exhaustive campaigns that enable these products to dominate the U.S. food system.

Industry Influence in the Political Sphere

The last key factor guaranteeing sugar its prominent place in the U.S. food economy and the nation's diet is the sugar industry's strong political influence, asserted through its own efforts and those of its ally, the psuedo food industry. A wide variety of strategies and resources function together to support and maintain the sugar industry's political leverage: these include financial contributions, lobbying, advertising, alliances and partnerships, threats, and more (Nestle, 2012, p. 358). These efforts are aimed at Congress, federal agencies, and nutrition and health professionals. In controlling and manipulating these authorities, the sugar and highly processed food industries work together to mold the overall U.S. food system and food environments to the industries' benefit (Winson, 2014, p. 8). Their goal is to ensure that government decisions and actions do not interfere with or harm sales of their products, and they are incredibly successful in accomplishing that goal (Nestle, 2012, p. 110).

Influencing U.S. Dietary Guidelines

This success is evident in the development of the country's official advice regarding sugar consumption. Dietary recommendations endorsed by the government are often considered unbiased and science-based, and therefore, honest and reliable, but in reality, the food industry plays a huge role in establishing them. For example, as the USDA revised recommendations for sugar consumption for the 2000 *Dietary Guidelines*, the sugar industry lobbied aggressively to prevent a wording change from "choose a diet moderate in sugars" to "limit your intake of sugars" (Uhlmann, 2000). Despite a lack of evidence proving this, the sugar industry felt that this more restrictive wording would damage their reputation and sales, so they spent substantial time and money thwarting this change, and of course, they were successful (Uhlmann, 2000). The more restrictive advice was not published. The industry has succeeded in thwarting attempted change like this intended to improve the *Dietary Guidelines* time and time again. As a result, the USDA did not establish necessarily restrictive advice regarding sugar intake until much later than they should have (HHS & USDA, 2015). The World Health Organization first published restrictive advice regarding sugar consumption in 2003–recommending that an upper limit of 10% of daily calories come from sugar–and the American Heart Association did the same in 2010–recommending that just 5% of daily calories come from sugar (WHO, 2002, p. 56). The USDA, however, was not on board with this advice until 2015, when they finally did limit recommended sugar consumption to 10% of ones daily calorie intake (HHS & USDA, 2015). By 2015, the evidence linking excessive sugar consumption to poor health was likely too abundant and strong for the sugar industry to fight, and they were forced to accept this restrictive advice from the USDA. However, the fact that the USDA compromised to endorse the WHO's less

restrictive limit on sugar intake rather than that advised by the AMA is noteworthy. The food industry's hand in shaping U.S. *Dietary Guidelines* is just one of many examples illustrating its power in the political sphere.

Financial Contributions from the Food Industry

One significant factor behind the food industry's political influence is its wallet; financial contributions are an extremely powerful tool in gaining the support of both legislators and health professionals (Roberts, 2012). According to the Center for Responsive Politics, the sugar industry alone spent over $40 million on donations to politicians between 1990 and 2016, and as of 2016, they were spending an estimated $10 million every year on these contributions (Rolnik, 2016). Due to the costs of election campaigns and the lack of public funding for them, the food industry's financial contributions to legislators are relied upon, and therefore, extremely effective (Nestle, 2012, p. 105). These donations guarantee the industry the favorable votes it needs to maintain an ideal sales environment (Brooks, Cameron, & Carter, 1998). While donations to health experts do not necessarily *guarantee* the industry favorable research conclusions regarding its products, they do allot the industry some control over what research is conducted, which conclusions are published, and how findings are presented (Nestle, 2012, p. 118). A handful of health professionals depend on this financial support to fund their research and actively seek it out, so like legislators, they too tend to cooperate willingly with the food industry (Nestle, 2012, p. 111). Because these monetary donations are so effective, the sugar industry allocates significant sums for nutrition experts as well. In 2015, for example, it became public knowledge that the Coca-Cola company provided researchers with millions of dollars in funding to downplay the link between sugar-sweetened beverages and obesity (O'Connor, 2016). Later in

2016, the Associated Press reported that candy makers were funding studies to suggest that children who eat candy weigh less than those who do not (O'Connor, 2016). Since these conflicts of interest were exposed, the backlash against them has provoked heightened levels of scrutiny from the public regarding potential conflicts of interest in other studies. However, these conflicts of interest still do exist, and they probably always will to some degree. This extravagant spending to support legislators and health and nutrition experts is key in providing the sugar and highly processed food industries the political environment and scientific evidence necessary for their continued economic success.

The "Revolving Door"

Another factor contributing to the industries' influence over Congress and federal agencies such as the FDA and the USDA is the "revolving door" that exists between food industry lobbyists and government officials (Abramson, 1998, p. AI & A22). Job exchanges between both legislators and lobbyists and officials of regulatory agencies and lobbyists occur astonishingly frequently (Abramson, 1998, p. AI & A22). Although former food lobbyists must cut all formal ties to their industry as they transition to government work, surely friendships and informal alliances remain that might influence their political decisions (Nestle, 2012, p. 101). Examining the opposite transition, when government officials retire their positions in politics to work for the industry, they bring valuable insight into governmental affairs that the industry would otherwise lack access to (Nestle, 2012, p. 101). This revolving door may not always provide the food industry with substantial, noticeable advantages, but it certainly does enhance its power in the political arena.

A wide variety of factors (consumer preference for sugar-enhanced processed foods, the money and power behind the sugar industry and its allies, intensive and confusing advertising by these industries, and the industries' political influence) play a role in creating this destructive dietary trap that the country is now stuck within. The U.S. population has come to depend on highly processed, sugar laden pseudo foods for sustenance, and by promulgating their prominence, this trap makes them extremely challenging to avoid despite modern knowledge of their negative health implications. Although it may feel hopeless at this point, the U.S. population *can* escape this system-wide trap and better the nation's diet. Chapter Six presents realistic suggestions regarding how to do so.

Chapter Six: Escaping The Trap

This chapter examines the path toward escaping the sugar trap the country is currently caught within. However–as explained in Chapter Five–because sugar is added to most highly processed foods and beverages and the majority of the country's sugar consumption comes through these products, escaping the sugar trap necessarily entails decreased consumption of these pseudo foods (Taubes, 2016, p. 43). Therefore, Chapter Six focuses on decreasing nutrient-poor, processed food consumption in general rather than just decreasing sugar consumption. Reducing pseudo food consumption would cut sugar consumption significantly, but it would simultaneously reduce the population's intake of a variety of other arguably toxic ingredients such as artificial flavors, preservatives, trans fats, etc. Because it remains controversial whether sugar is the primary cause of obesity and associated chronic disease or if some other aspect of pseudo foods is the culprit, it is currently a more realistic suggestion to focus on reducing general pseudo food consumption rather than just sugar consumption in particular. Therefore, that strategy–decreasing pseudo food consumption to indirectly reduce sugar intake and better the country's overall health–is the focus throughout this chapter.

Today's profit-driven food system has utterly failed to provide the U.S. population with a healthy diet. It promotes overconsumption and nutrient-poor, disease-promoting food choices–pseudo foods–because these things further the economic profitability of the food industry. In order to reverse the obesity epidemic and decrease chronic disease rates, the government must step in to transform the U.S. food system. Unless the rules and regulations surrounding food provision change, the health of the nation will not either. Some progress has already been made in bettering the country's food environments, and that progress deserves recognition. However,

significant change is still necessary to derive visible, noteworthy improvements in the population's health. This chapter presents potential long and short-term government solutions to the health crisis the country faces, which would function to cultivate food environments that promote healthy eating.

Recent Progress

While there is certainly still much progress to be made, the recent U.S. health movement has generated some headway in improving the U.S. food environment already.

The "Let's Move" Campaign

One step in the right direction was first lady Michelle Obama's Let's Move campaign. This initiative was announced on February 9, 2010 as a campaign to address childhood obesity (The White House, 2010). While its title implies a focus on physical activity, its initial goals were aimed primarily at transforming diet rather than promoting physical activity (White House Task Force on Childhood Obesity, 2010). The campaign was named so unsuitably to avoid upsetting the food industry, which Obama certainly would have done with any title implying a recommendation to eat less of any certain food or to eat less in general (The White House, 2010). However, the campaign's objectives clearly prioritize revamping the diet of the nation's youth: its original objectives were "(1) creating a healthy start for children, (2) empowering parents and caregivers, (3) providing healthy food in schools, (4) improving access to healthy, affordable foods, and (5) increasing physical activity," in that order (White House Task Force on Childhood Obesity, 2010). Let's Move has made significant progress with successful policy implementation aimed at raising awareness about the importance of healthy eating and securing healthier food

options for U.S. youth (The White House, 2012). Some of the initiative's specific accomplishments include increasing funding for and improving access to school meals, moving salad bars into schools, setting new nutrition standards for school meals, launching an improved food guide, persuading restaurant chains to commit to offering healthier kids' meal options, and obtaining commitments from large grocers to expand access to healthier food in underserved, low-income areas (The White House, 2012). These accomplishments are groundbreaking; moreover, the publicity the campaign has received has generated attention to healthy eating on a level that would have been unattainable without its efforts (The White House, 2012). However, the campaign's plans that were either altered or impeded due to food industry pushback vastly outnumber its successes (Nestle, 2012, p. 391). According to lobbying records, the food industry more than doubled its spending from 2009 to 2012, throughout the development and launch of Let's Move (Roberts & Wilson, 2012). As a result of this industry pushback, the majority of Let's Move's specific recommendations have yet to be effectively implemented; moreover, childhood obesity has only increased since 2010 (Hales et al., 2017). Although the Let's Move campaign has thus far been unable to overcome the food industry's strong forces and triumph in each of its endeavors, it has succeeded in bettering the food environment and furthering the conversation around healthy eating within the media.

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In the wake of the Let's Move launch, government departments and agencies have successfully implemented a variety of regulations for food industry practices to promote a healthier diet. For example, the FDA now requires chain restaurants (to which the rule applies) to give consumers access to calorie and nutrition information; this regulation took effect in May of

2018 and is estimated to save approximately $8 billion in health costs over the next 20 years (FDA, 2019). Similarly, the FDA requires vending machine operators (to whom the rule applies) to disclose calorie information for food sold from vending machines as well (FDA, 2019). In addition to mandating menu and vending machine labeling, the FDA has also modified the Nutrition Facts label on packaged products to "make it easier for consumers to make better informed food choices" (FDA, 2019). Some of the modifications include larger and bolder type used to indicate the serving size and calories within a product and the amount and percent daily value of added sugars listed in addition to just total sugars (FDA, 2019).

These changes are constructive and valuable; however, their purpose is simply to educate the public rather than to actually modify the food environment and promote behavior change more forcefully. Efforts to accomplish the latter are more threatening to the food industry, and therefore, have been considerably less successful (Nestle, 2012, p. 393). One such effort is to impose an excise tax on soda or sugary drinks. In 2008, New York governor David Paterson suggested taxing soft drinks (not including diet sodas, juices, milk, or water) by 18%, and by mid 2012, more than 30 other states considered similar proposals (Paterson, 2008). However, none of these state-wide soda tax attempts were successful, as they were countered by the soda industry's over $70 million lobbying efforts against them (Stanford, 2012). A few U.S. cities have succeeded in establishing soda taxes, but these taxes are not as effective as planned due to the small areas to which they apply: most consumers appear to either pay the tax or travel to nearby, exempt municipalities to purchase their sugary drinks there instead (Tuchman et al., 2019). A similar effort to curb sugar-sweetened beverage consumption was New York's attempt at capping soda sizes. This initiative was announced in May of 2012 but was also met with typically

aggressive opposition from the soda industry, and the regulation was ultimately repealed (Grynbaum, 2014). Even though these more direct efforts to improve dietary choices technically failed, they have received extensive media attention, so at the very least, they have succeeded in furthering the conversation on the obesity crisis and the link between obesity and soda consumption. Furthermore, improvements in food labeling, menu labeling, and vending machine labeling have made it easier for the American public to make educated, healthy diet choices and, ideally, have advanced general education regarding healthy eating and food choices in the process. However, the research regarding the impact of calorie labeling on food packaging and restaurant menus is mixed; some findings indicate that it improves diet choices, but some claim it has no noteworthy effect (Roberto et al., 2010; Dumanovsky et al., 2011; Hawley et al., 2013; Elbel et al., 2009; Kelly et al., 2009). Further research over more extended periods of time are needed to determine its long-term impact.

The Food Movement

Alongside these recent, either attempted or successfully implemented, improvements to the country's food system, a local food movement has gained traction among the American public. Within the past decade, healthier food choices have become more widely available and more popular, public interest in food and food issues has disseminated throughout the country across racial and social groups, and a renewed demand for local food production has developed as well. As a result of this newfound public passion for diet and health, food issues are taken into serious consideration by national and even international governments, and the media covers food and food issues extensively (Nestle, 2012, p. 411). Although the local food movement is not yet

strong and coherent enough to overcome the power behind the profit-based food system and make significant improvements to the population's health, it is certainly a hopeful start.

What Is Missing: Requirements for Future Change

Heightened public knowledge on healthy eating and its significance and a general attitude shift toward accepting–and even striving for–a healthy diet are both key advancements in combatting the obesity crisis. However, judging by general health trends and food choices, these improvements are not sufficient to generate the level of change necessary to revamp the nation's diet and cultivate a healthy population (Trust for America's Health, 2018 & Haspel, 2016). In order to exact meaningful change, a political and economic transformation of the U.S. food system is necessary.

Some suggest that because food provisioning through the modern system based on for-profit enterprise has failed to yield a healthy diet, the country will never overcome its health crisis until it replaces this system with something along the lines of community food security (Winson, 2014, p. 41). Community food security is a relatively new concept that focuses on regional and local food systems and, by doing so, "allows all community residents [to] obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self-reliance and social justice" (Hamm & Bellows, 2003, p. 37). While a system of this kind seems like the best option for the population's health and that of the planet and, therefore, should function as a long-term goal, it is not a realistic expectation for the short-term. The political-economic model that orients the U.S. food economy is far too firmly ingrained and drastically dissimilar for a state-led food provisioning system like community food

security to successfully supersede it any time soon. For now, the government should take small steps to slightly alter and increase its involvement in the U.S. food system to prioritize nutrition over economic profit.

Agricultural Subsidies

One key adjustment the government could make to its involvement in the U.S. food system is to subsidize crops that would reverse the obesity epidemic rather than those that promote it. Agricultural subsidies fund the production of key ingredients within the highly processed foods that health experts blame for the obesity crisis, making these foods inexpensive to produce and highly profitable (Inskeep, 2013). The government has created an environment in which these health-destroying foods are the most economically valuable, so it should re-distribute its subsidies to promote healthy eating instead. Rather than funding the production of commodities like corn, soybeans, wheat, and rice–the majority of which is not eaten as is, but instead eventually constitutes the highly processed "junk food" that dominates the American diet–the government should finance fresh produce production. The USDA recommends that half of one's plate consists of fruits and vegetables, but current agricultural policies completely undermine this advice (2019). If the government is to accomplish its public health goals and improve the nation's diet, it must make healthy eating an economically feasible reality.

Lobbyist Regulations

However, a policy that would redirect government subsidies in this way–or any other policy that would so disrupt the most powerful players in the food industry–likely would not pass with today's ineffectual lobbying laws in place. While extensive lobbyist regulations do exist, they ultimately fail to accomplish their intended goal–to insure that lobbying efforts do not

undermine the public good (Drutman, 2015). Under today's lobbying laws–weak and replete with loopholes–corporate lobbying efforts are unrestrained and, therefore, commonplace and extremely influential (Drutman, 2015). Politicians have come to depend on lobbyist contributions to finance their campaigns; corporations and their lobbyists are too powerful for legislators to defy them (Drutman, 2015). In order to successfully implement policies that prioritize healthy eating, the government must establish more restrictive laws governing campaign contributions and lobbying to decrease the food industry's influence in government affairs.

Food Labeling and Advertising

More stringent lobbying laws would function to counter the food industry's heavy influence on policy-making; in order to counter its equally heavy influence on consumers' food choices through its extensive marketing and advertising efforts, the government should strengthen current regulations on industry advertising and food labeling. As mentioned in the previous section, the FDA has made significant improvements recently to food and menu labels to better inform the public about the nutrition content of its food (2019). However, there is still progress to be made. Since the turn of the century, food companies have experimented with several front-of-package food labeling systems in response to government coercion to do so (IOM, 2011). Today, several food companies use the Facts Up Front system–first introduced by the Grocery Manufacturers Association and the Food Marketing Institute in 2011 under the name Nutrition Keys–to summarize important nutrition information on the front of their packaging (GMA, 2019). However, the decision to display this front-of-package label is completely voluntary (GMA, 2019). The FDA should require this practice from all packaged food producers

so that consumers are more aware of the health implications of their food choices. Also voluntary is food companies' decision to regulate their marketing efforts directed toward children too young to differentiate sales material from genuine, objective information (FTC, 2019). In 2009, the FTC assembled the Interagency Working Group on Food Marketed to Children (IWG) to establish nutrition standards for foods marketed to children (FTC, CDC, FDA, & USDA, 2009). These standards were lenient and unenforceable by law, yet they were still met with aggressive opposition from the food industry (Nestle, 2012, p. 400). As a result, the IWG loosened their standards further in late 2011 (FTC, 2011). Today, the FTC claims it is "actively working with government agencies, consumer advocates, academics, and industry to foster creative and effective self-regulatory [(aka voluntary)] initiatives to help combat childhood obesity," but judging by relevant statements, reports, and press releases, no concrete efforts have been made on the matter since 2012 (FTC, 2019). The FTC should not only intensify these suggested nutrition standards for foods that can be marketed to children, it should *mandate* that food companies abide by them. Lastly, the FDA should establish more severe regulations on the health claims it allows food companies to make about their products, as current regulations are shockingly liberal (FDA, 2019). Food producers add functional ingredients (such as fiber and various vitamins and minerals) to "junk food"–nutrient-poor products filled with added sugar, saturated fat, and salt–so they can market them as health-promoting (Singer, 2011). As discussed in Chapter One, these fortified foods often provide little to no noticeable health benefits, but the FDA permits their producers to market them as healthy anyway based on extremely weak, ambiguous evidence proving the health claims they advertise (FDA, 2019 & Singer, 2011). To

insure that consumers are not misled by industry marketing for these fortified food products, the FDA must intensify its standards for permitted health claims.

Funding Public Health Campaigns

Because the food industry's advertising budget is so immense, the majority of the public's nutrition and diet advice comes from advertising and PR efforts of the food industry (Nestle, 2012, p. 29). Government-led health campaigns cannot even compete with industry-led campaigns in scope and scale due to the disparity between the financial backing behind the two. To illustrate, just over a decade ago in 2006, the 9 most powerful companies selling highly processed food products spent over $9 billion to promote their brands in the US, an amount approximately 544 times greater than the U.S. Health and Human Services advertising budget that year (*Advertising Age,* 2007). While the health advice conveyed through food industry advertising and PR campaigns is not inaccurate, it is often predictably subjective–angled to paint its corporate backers and their products in a good light–and phrased in euphemisms (Nestle, 2012, p. 3). As such, it can be confusing and misleading for consumers who presume it to be objective fact. In order to clarify health information for consumers as much as possible, the government should increase allocated funding for public health campaigns so that these more genuine, objective information sources are more widespread and effective.

Junk Food Taxes

Instead of pulling money from other causes within the current budget to better support government-run health campaigns, the state could raise these extra funds by taxing junk food. Not only would junk food taxes increase funding for public health campaigns thereby advancing public knowledge on diet and nutrition, they would also decrease general consumption of these

nutrient-poor food products, studies show (Peñalvo et al., 2017). Placing modest excise taxes on highly processed, nutrient-poor foods would deter some consumers from purchasing these foods due to the additional costs incurred by choosing them, but they would also discourage consumption of these products by altering their social meaning. Excise taxes are associated with stigmatized behavior such as smoking and pollution; applying them to junk food would transfer this stigma to the consumption of these products and discourage it (Peñalvo et al., 2017).

Restricting Children's Access to Junk Food

Another strategy that might reduce the country's junk food consumption by enhancing the social stigma associated with it is restricting children's access to junk food in the same way that their access to alcohol and tobacco is restricted. Society protects children from potentially damaging products and behaviors because their autonomy (i.e. their capacity to self-govern) is not yet fully formed; they are still vulnerable and dependent and have a moral right to protection (Bach, 2018, p. 108). Restrictions on a child's free choice function to protect his future autonomy:

> "When a mature adult has a conflict between getting what he wants now and having his options left open in the future, we are bound by our respect for his autonomy not to force his present choice in order to protect his future 'liberty'…Children are different. Respect for the child's future autonomy, as an adult, often requires preventing his free choice now" (Feinberg, 1980, p. 127).

Proponents of a policy to restrict children's access to certain junk food products argue that these foods are so clearly linked to chronic disease (sugar-sweetened beverages, for example) that they are equally as threatening to a child's wellbeing and future as products like alcohol and tobacco;

therefore, they should be similarly off-limits (Bach, 2018, p. 108). Unlike alcohol and tobacco products, the government should not completely illegalize a child's consumption of these junk foods, as that might be too extreme. It should only prohibit vendors to sell these products to minors. With this policy in place, parents could still provide these tasty junk food products for their children if they so desire–perhaps on special occasions only–but general consumption of them would certainly decrease. By restricting children's access to these junk foods, society places them within the same schema as other products and activities from which the country's youth are barred due to the risk and danger associated with them, thereby changing their social meaning (Bach, 2018, p. 113-4). This new social understanding of junk food consumption would indubitably decrease the long-term frequency with which it occurs (Bach, 2018, p. 113-4).

Objections and Replies

An obvious, commonly-used objection to government interference in the country's food system, like that proposed in the previous section, is that this state involvement would unfairly hinder citizens' freedom of choice. Those opposed to government interference argue that healthy options are available to consumers, and it should be left up to them to choose them; the government should not intervene to force or even stimulate healthy eating. However, the government already plays such an influential role in the population's food choices as it is. Through its current policies and subsidies, which support the powerful oligopoly of highly processed, nutrient-poor food producers in the food industry, the government promotes sub-par food choices and general overconsumption. Due to this government involvement and the extensive food industry advertising that permeates society today, consumers' "free choice" is

already heavily undermined by the modern U.S. food system. Instead of using its influence to create a food environment that enables and encourages an unhealthy diet, the government should interfere (with policies like those outlined in the previous section) to promote health.

Another objection to altering the country's food system through modified and increased government involvement is that this change would generate severe economic disruption. If the vast majority of the population changed its diet to reverse the obesity epidemic and avoid chronic disease, an economic transformation would necessarily follow. This change would obviously impact food producers, requiring certain sectors of the industry to increase production and others to downsize. However, it would also require food sellers to alter their product and menu choices accordingly, media corporations and advertising agencies to modify their client bases and campaign strategies, and drug and health care industries to revise their product mix to cater to a healthier population with new and different health needs. A vast range of economic sectors would be impacted by a general shift in the country's diet, and while some would prosper as a result of this change, a good portion of the population would suffer at first as the economy adjusted to this new normal. While these economic realities are consequential and alarming, they are not a sufficient excuse to rationalize the continuation of today's health-destroying food environments. To illustrate why, consider technological advancement; technology is ever-changing, ever-progressing, and as such, businesses struggle to keep up with it; companies and even entire industries suffer regularly as a result of technological progress. However, technology's potential to generate economic disruption does not prevent society from embracing its progress, nor should it prevent society from promoting a healthy diet either. The economy would eventually adjust to flourish while effectively serving a healthier U.S. population, and short-term economic

disruption is a worthwhile price to pay for the significant increases in health and longevity that would result.

While altering and increasing government involvement in the U.S. food system is highly controversial due to the challenges it would present and the comprehensive political and economic change it would require, the population's physical health and wellbeing should be a priority of the food system, and history has illustrated that the current for-profit food system fails to make it one. The government *must* step in if the country's food environments and choices are to change.

Conclusion

This thesis examined the role sugar has played in the U.S. diet and in the obesity epidemic and resulting health crisis that the nation faces today. While the evidence presented within the first half of the thesis makes it seem as though sugar must be responsible for the country's current health issues, the general public does not recognize it as such. Chapters Four and Five explore society's failure to acknowledge the apparent risks associated with sugar consumption and the power and influence exonerating and supporting the sweet commodity. The final chapter, Chapter Six, discusses a variety of recommendations the government might consider to decrease the population's sugar consumption and improve overall health.

As explained several times throughout this thesis, while sugar consumption appears responsible for a variety of chronic diseases crippling the U.S. population, there is no way to *prove* that sugar is the sole cause of these health problems. Moreover, it most likely is not; research supports the notion that a collection of other factors contribute to the U.S. health crisis as well. These factors include other aspects of the modern Western diet–such as excess saturated and trans fat consumption and chemical additives–and non-dietary, environmental factors–such as pollution and radiation. The purpose of this thesis is not to ignore or discount these other factors potentially provoking chronic disease, but rather, to illustrate that sugar is likely much more culpable and toxic than the average citizen considers it to be. Therefore, the country should put forth much greater effort than it currently does to decrease today's excessive consumption of this potentially damaging sweetener.

In order to reduce sugar consumption successfully, the government must step in to instigate an economic and political transformation of the current food system. However, this

government involvement cannot happen without the support of the general public; if the economic superpowers of the food industry fight back against government interference to promote healthy eating and the remainder of the population does too, a healthy diet for all will be unattainable. In order to develop a new food system that promotes healthy eating rather than undermines it, the majority of the population must get on board and embrace this change. To show support for a healthy food environment, consumers must vote with their forks: when possible, consumers should buy whole, natural foods over packaged, highly processed options, read labels and choose products without added sugar and chemical additives, buy organic, fresh fruits and vegetables, and choose locally grown and raised products and restaurants that utilize them as ingredients.

Healthier U.S. food environments are within reach; the "inescapable" sugar trap *is,* in fact, escapable; but in order to accomplish these goals and improve the nation's health, the country must form a united front and actively strive for change.

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